Serious Injury Among Older Californians

Epidemiology and Prevention for Injury Control (EPIC) Branch

California Department of Health Services

State of California

Grantland Johnson, Secretary
California Health and Human Services Agency

Diana M. Bontá, R.N., Dr.P.H., Director
Department of Health Services

December 2000

EPIC Proportions

EPIC Proportions is a series of reports on injury control produced by the Injury Surveillance and Epidemiology Section (ISES), Epidemiology and Prevention for Injury Control (EPIC) Branch, California Department of Health Services (DHS).

Arthur A. Ellis, M.A., Research Scientist in ISES, prepared this report.

Acknowledgments

Many reviewers immeasurably improved this report. The entire document was reviewed by: Merry Holiday Hanson, Ph.D. and EPIC staff. Reviewers of the special topics were: Janice A. Wright, M.S., R.N., Chief, Preventive Care for the Aging, DHS for Overview and Fall injuries; Elizabeth McLoughlin, Sc.D., San Francisco Injury Center for Research and Prevention for Assault/Homicide; Mary K. Janke, Ph.D., Erin Healey, M.A., Marc Chaderjian, Ph.D., California Department of Motor Vehicles for Motor Vehicle Occupant Injuries; Diane Winn, R.N., M.P.H., Pediatric Injury Prevention Research Group, U.C. Irvine for Pedestrian vs. Motor Vehicle injuries; and Michael Males, M.A., Instructor in Social Ecology, U.C. Irvine for Suicide. Cristina Campbell, Pat Stewart, and Debbie Jan, librarians at U.C. Berkeley's Public Health Library, conducted wonderful literature searches.

We acknowledge the California Department of Justice for providing a homicide file and the California Wellness Foundation for providing the funding to link the homicide to DHS' vital statistics death records.

Feedback

How useful do you find this report? Will the data and analysis contribute to your injury prevention efforts? We appreciate your feedback and value your comments and questions. Please send them to:

Roger B. Trent, Ph.D., Chief
Injury Surveillance and Epidemiology Section
California Department of Health Services
P.O. Box 942732, MS 39 A
Sacramento, CA 94234-7320
(916) 323-3611
rtrent@dhs.ca.gov

Serious Injury Among Older Californians

Epidemiology and Prevention for Injury Control (EPIC) Branch

California Department of Health Services

Donald O. Lyman, M.D., Chief
Division of Chronic Disease and Injury Control

Alexander Kelter, M.D., Chief
Epidemiology and Prevention for Injury Control Branch

Roger B. Trent, Ph.D., Chief
Injury Surveillance and Epidemiology Section
Epidemiology and Prevention for Injury Control Branch

Table of Contents

Executive Summary

As people age, they face an increasing risk of injury from falling, car crashes, and even suicide. Injuries are a major threat to California's seniors and an important public health concern. Therefore, it is critical to understand and reduce elder injuries. The purpose of this report is to provide data to support the prevention efforts of prevention workers, policy makers, academicians, and other constituencies.

This report addresses the most serious geriatric injuries only—those resulting in death or hospitalization among California residents 55 years and older. Here are some of the important findings:

Overview

- In 1995, there were 3,916 fatal and 85,640 hospitalized nonfatal injuries (Table A1).
- The top three *fatal* injuries in 1995 were suicide, motor vehicle traffic injuries, and falls. The top three *nonfatal* injuries are falls, motor vehicle traffic injuries and poisoning (Table A2).
- Although injuries kill or hospitalize many of California's seniors, every major type of injury has been dropping over the 11-year period, 1985-1995 (Figure A4).
- In 1995, hospital charges for nonfatal elder injuries amounted to $1.7 billion (average charges totaled $19,141) for 651,341 hospital days (average stay of 7.3 days) (TableA8).

Special Topics (Alphabetical Order)

- ***Assault/Homicide***. In 1995, there were 983 nonfatal assaults among Californians 55 years and over. Males, blacks, and persons age 85 and over were at highest risk (Table B1.2). There were also 219 homicide deaths. Males, blacks, and persons age 55-64 were at highest risk (Table B1.8).
- ***Falls***. Falls accounted for 764 fatal and 59,481 nonfatal injuries requiring hospitalization. At highest risk are males for fatal and females for nonfatal injuries. Whites and very old seniors are also at high risk (Table B2.2).
- ***Motor Vehicle Occupant***. Of seniors injured in motor vehicle collisions in 1995, 556 died and 4,369 were hospitalized. At highest risk for fatal injuries are males, whites, and people in the 75-84 age group. For nonfatal injuries, risk is highest for females, whites, and people in the 85 years and older age group (Table B3.1).
- ***Motor Vehicle Versus Pedestrian***. The toll of elder pedestrians hit by a motor vehicle: 278 killed and 995 hospitalized. For both fatal and nonfatal injuries, most at risk are males, Asians, and persons 85 year and over. Risk climbs with advancing age (Table B4.1).
- ***Suicide.*** There were 1,148 elder suicides in 1995. The highest rates are among males, whites, and those 85 years and over (Table B5.2).

Introduction

Injuries are a major threat to California's seniors. In 1995, there were 3,916 fatal injuries and 85,640 nonfatal injuries serious enough to cause hospitalization.[†] Each day of the year, injuries killed about 11 and hospitalized an additional 235 California residents 55 years and older.

Elders have more than their share of injuries. For 1995, persons 55 and over were 18 percent of the state's population, but represented 23 percent of fatal injuries, and 40 percent of nonfatal injuries. Yet, injury is not a leading source of death among seniors ages 55 and older, eclipsed by cancer, heart disease, and others.

With a disproportionately high share of injuries, it is relevant to note that the elder population 55 years and over is expected to grow at a much faster rate than the younger population under 55 years. California Department of Finance demographers have projected the state's population to the year 2040. From 1995 to 2040, a 45-year period, the population is expected to increase by 65 percent for the younger population and 164 percent for the older population.

California Population Estimates for 1995 and Projections for 2040
by Age and Race/Ethnicity, Percentage Distribution

	1995 Estimates		2040 Projections	
	<55 Years	55+ Years	<55 Years	55+ Years
Total	100.1	100.0	100.0	100.0
[Number]	26,318,029	5,744,883	43,538,109	15,192,897
White	49.8	70.9	26.1	43.8
Hispanic	31.5	14.3	53.0	32.9
Asian/PI*	10.8	8.8	14.8	17.3
Black	7.4	5.5	5.6	5.3
Other	0.6	0.5	0.5	0.7

* Pacific Islander

Source: California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998; and California Department of Finance, 1970-2040 Race/Ethnic Population for Counties with Age and Sex Detail, Estimated 1970-1996, Projections 1997-2040. December 1998. Prepared by the Department of Health Services, EPIC Branch.

This report provides 1995 data covering serious injuries resulting in death or hospitalization. We cover the first hospitalization for an injury only. We do not present data on the vastly larger number of injuries treated in hospitals' emergency departments, doctors' offices, or at home because no existing statewide data system includes them.

Our objective in producing this report is to support the public health community in setting priorities and develop strategies to help reduce serious injuries among California's elders.

[†] How we classify injuries has changed since our last *EPIC Proportions* report. See Appendix: Important Methodological Note.

Overview

1. What was the incidence rate of fatal and nonfatal injuries among older Californians in 1995?

Overall Incidence. There were 3,916 fatal (Table A1) and 85,640 nonfatal (Table A2) injuries resulting in hospitalization in 1995. There are nearly 22 nonfatal injuries for each fatal injury. The incidence rate per 100,000 is 68.2 for fatal injuries, with the rates climbing with advancing age (Table A1).

The overall incidence rate per 100,000 for nonfatal injuries is 1,490.7, with rates rising tenfold between ages 55-64 and 85 and over (Table A2). The oldest age group is most vulnerable for both fatal and nonfatal injuries.

Fatal Injuries. Suicide is the leading fatal injury among older Californians (Table A1). The 1,148 suicides made up nearly 30 percent of all fatal injuries in 1995. The overall suicide rate is 20.0. Suicide is the most common fatal injury among all but the oldest age group, as Figure A1 shows. Firearms are the dominant mechanism of suicide, with 698 cases or 61 percent of all suicides.

Motor vehicle (MV) traffic injuries comprise the second leading fatal injury category, with 26 percent of all fatal cases and an incidence rate of 17.9. The rate for the 55-64 age group is three times larger than the rate for the 85 and over group (Table A1). A majority (54%) of MV traffic injuries involved a crash that fatally injured the occupant.

Falls are the third leading fatal injury, accounting for one in five fatal injuries at a rate of 13.3. The fall death rate jumps 25-fold between the youngest and oldest age group (Table A1). Falls are the leading fatal injury among Californians 85 years and over (Figure A1).

Nonfatal Injuries. Falls are the leading nonfatal hospitalized injury, with 59,481 cases (or nearly 70% of nonfatal cases) and an incidence rate of 1,035.4. The rate for the 85 and over age group is 20 times higher than the 55-64 age group (Table A2). MV traffic injuries are the second leading nonfatal injury category, with 11 percent of nonfatal cases and a rate of 171.6. The rate for MV traffic injuries climbs by nearly fourfold from the 55-64 age group to the 85 and over age group (Table A2). Poisoning is the third leading nonfatal injury, with three percent of cases and a rate of 50.5.

Table A1. Fatal Injury Rates (per 100,000) by Cause of Injury and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Injuries	**3,916**	**68**	**1,164**	**50**	**1,045**	**53**	**1,045**	**93**	**662**	**187**
Suicide	1,148	20	397	17	335	17	308	27	108	31
» Firearms	698	12	224	10	213	11	208	19	53	15
» Other Suicide	144	3	54	2	44	2	33	3	13	4
» Poisoning	133	2	58	3	38	2	25	2	12	*
» Hanging	110	2	51	2	24	1	22	2	13	*
» Suffocation	63	1	10	*	16	*	20	2	17	*
MV Traffic	1,028	18	297	13	304	16	295	26	132	37
» Occupant	556	10	173	7	176	9	160	14	47	13
» Pedestrian	278	5	86	4	83	4	78	7	31	9
» Unspecified	165	3	26	1	39	2	47	4	53	15
» Pedal Cyclist	23	0	10	*	3	*	10	*	0	*
» Motorcyclist	6	*	2	*	3	*	0	*	1	*
Fall	764	13	76	3	148	8	243	22	297	84
Homicide	219	4	111	5	52	3	38	3	18	*
» Firearms	93	2	57	2	20	1	12	*	4	*
» Cutting & Piercing	41	1	16	*	12	*	10	*	3	*
» Hanging	24	0	8	*	6	*	6	*	4	*
» Other Homicide	61	1	30	1	14	*	10	*	7	*
Poisoning, Unintentional	177	3	107	5	35	2	24	2	11	*
Fire/Burn	110	2	30	1	41	2	28	2	11	*
» Fire/Flame	104	2	29	1	38	2	26	2	11	*
» Hot Object/Substance	6	*	1	*	3	*	2	*	0	*
Suffocation	97	2	20	1	20	1	25	2	32	9
Drowning/Submersion	94	2	27	1	24	1	28	2	15	*
Late Effects	55	1	17	*	20	1	12	*	6	*
Other Specified, Classifiable	17	0	8	*	4	*	4	*	1	*
Undetermined	44	1	13	*	17	*	4	*	10	*
Natural/Environmental	38	1	7	*	13	*	9	*	9	*
» Bites & Stings	1	*	0	*	1	*	0	*	0	*
» Other Environmental	37	1	7	*	12	*	9	*	9	*
Transport, non-MV	38	1	17	*	9	*	9	*	3	*
Pedestrian, non-MV	38	1	15	*	11	*	6	*	6	*
Machinery	19	0	11	*	5	*	3	*	0	*
Struck By Object	15	0	6	*	2	*	4	*	3	*
Pedal Cyclist, non-MV	6	*	1	*	3	*	2	*	0	*
Overexertion	4	*	1	*	1	*	2	*	0	*
Firearm, Unintentional	2	*	2	*	0	*	0	*	0	*
Other Injuries	1	*	0	*	0	*	1	*	0	*
Legal Intervention/War	1	*	1	*	0	*	0	*	0	*
Cutting & Piercing	1	*	0	*	1	*	0	*	0	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998. Prepared by the Department of Health Services, EPIC Branch.

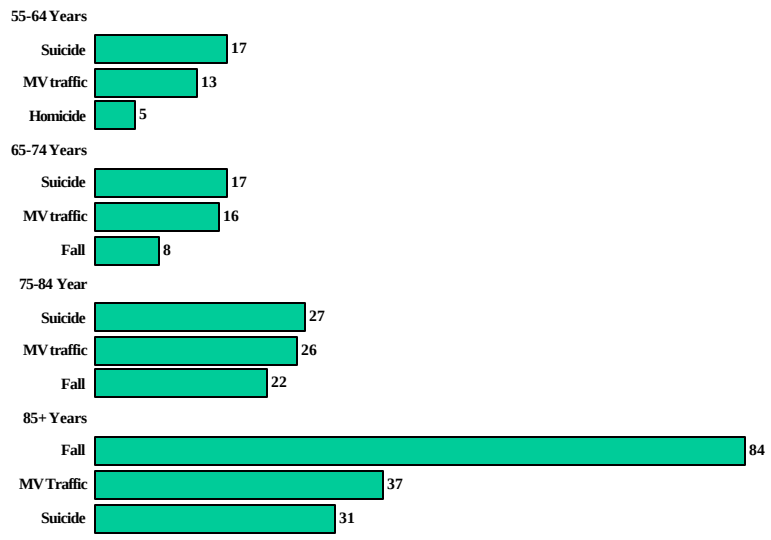
Table A2. Nonfatal Hospitalized Injury Rates (per 100,000) by Cause of Injury and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Injuries	**85,640**	**1,491**	**14,049**	**607**	**20,907**	**1,070**	**28,949**	**2,580**	**21,735**	**6,144**
Fall	59,481	1,035	6,169	266	12,807	656	22,096	1,969	18,409	5,204
MV Traffic	9,856	172	2,548	110	3,040	156	2,824	252	1,444	408
» Occupant	4,369	76	1,349	58	1,436	74	1,184	106	400	113
» Pedestrian	995	17	313	14	338	17	253	23	91	26
» Motorcyclist	222	4	120	5	68	3	22	2	12	*
» Pedal Cyclist	100	2	45	2	37	2	14	*	4	*
» Other MV	47	1	9	*	21	1	15	*	2	*
» Unspecified	4,123	72	712	31	1,140	58	1,336	119	935	264
Poisoning	2,902	51	786	34	965	49	802	71	349	99
Late Effects	2,099	37	704	30	670	34	491	44	234	66
Overexertion	1,956	34	588	25	604	31	520	46	244	69
Suicide	1,517	26	657	28	421	22	316	28	123	35
» Poisoning	1,242	22	560	24	347	18	245	22	90	25
» Cutting & Piercing	138	2	49	2	41	2	37	3	11	*
» Firearms	29	1	9	*	7	*	8	*	5	*
» Hanging	5	*	3	*	1	*	1	*	0	*
» Other Suicide	103	2	36	2	25	1	25	2	17	*
Natural/Environmental	1045	18	274	12	318	16	300	27	153	43
» Bites & Stings	525	9	171	7	181	9	139	12	34	10
» Other Environmental	520	9	103	4	137	7	161	14	119	34
Struck By Object	1,004	17	300	13	303	16	246	22	155	44
Assault	983	17	458	20	275	14	171	15	79	22
» Fight	311	5	140	6	99	5	55	5	17	*
» Firearms	109	2	65	3	29	1	9	*	6	*
» Cutting & Piercing	103	2	67	3	22	1	5	*	9	*
» Poisoning	3	*	1	*	1	*	1	*	0	*
» Hanging	3	*	1	*	1	*	1	*	0	*
» Other Assault	454	8	184	8	123	6	100	9	47	13
Other Specified, Classifiable	916	16	228	10	203	10	263	23	122	34
Fire/Burn	732	13	234	10	211	11	195	17	92	26
» Fire/Flame	270	5	90	4	94	5	58	5	28	8
» Hot Object/Substance	462	8	144	6	117	6	137	12	64	18
Cutting & Piercing	679	12	275	12	241	12	123	11	40	11
Transport, non-MV	600	10	215	9	179	9	141	13	65	18
Suffocation	539	9	84	4	180	9	183	16	92	26
Other Specified Injuries	421	7	95	4	122	6	119	11	85	24
Pedal Cyclist, non-MV	345	6	176	8	109	6	49	4	11	*
Machinery	245	4	137	6	69	4	33	3	6	*
Undetermined	131	2	46	2	37	2	31	3	17	*
Pedestrian, non-MV	104	2	33	1	32	2	31	3	8	*
Legal Intervention/War	18	*	9	*	4	*	4	*	1	*
Firearm, Unintentional	37	1	20	1	11	*	6	*	0	*
Drowning & Submersion	30	1	13	*	6	*	5	*	6	*

* Rates were not computed for fewer than 20 cases.

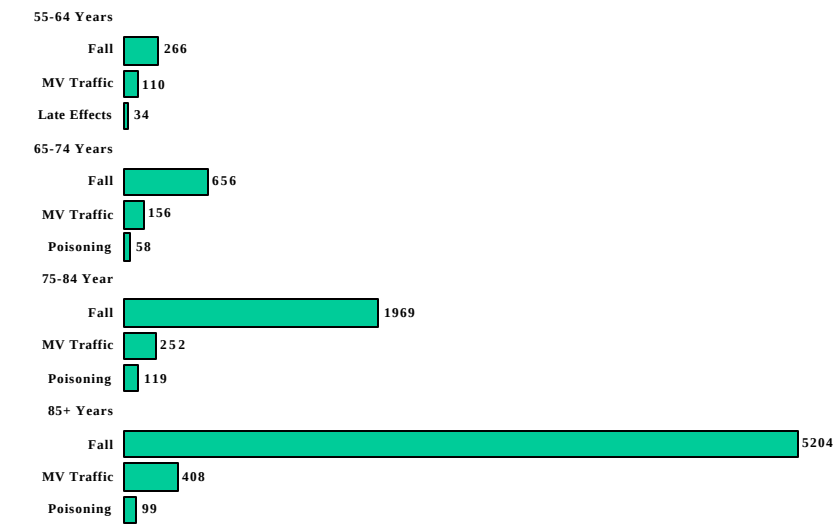
Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998. Prepared by the Department of Health Services, EPIC Branch.

Figure A1. Top three Causes of Fatal Injury Rates (per 100,000) by Age Group, California Residents Age 55 and Over, 1995



Source: Table A1

Figure A2. Top three Causes of Nonfatal Injury Rates (per 100,000) by Age Group, California Residents Age 55 and Over, 1995



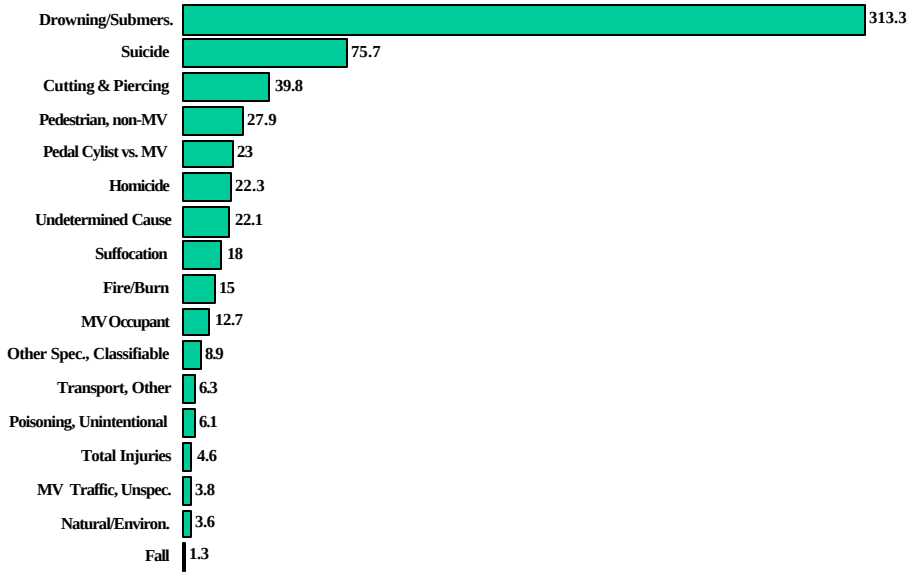
Source: Table A2

2. How "lethal" are injuries to the elderly in California?

Figure A3 displays a "lethality ratio" for leading injuries, defined as fatalities per 100 nonfatal hospitalizations. The lethality ratio is important for injury prevention because it illustrates the relationship between fatal and nonfatal injuries and directs our attention to those with the greatest potential for saving lives. For example, it answers the question, "How many older Californians died for every 100 hospitalized survivors of falls?" Looking at the bottom of Figure A3, we see that only 1.3 persons died for every 100 people who were hospitalized and lived because of a fall. Since falls are the least lethal of the leading injuries and 70 percent of nonfatal injuries are falls, they influence the ratio across all injuries (4.6). (Falls can be more lethal if combined with other diagnoses.)

At the high end, with a ratio that dwarfs all others, is drowning and submersion (313.3), followed by suicide (75.7). In other words, drowning and submersion causes 313 deaths for every 100 hospitalizations.

Figure A3. "Lethality Ratio"* of Leading Injuries,
California Residents Age 55 and Over, 1995



*Fatalities per 100 nonfatal hospitalizations.
Source: Tables A1 and A2.

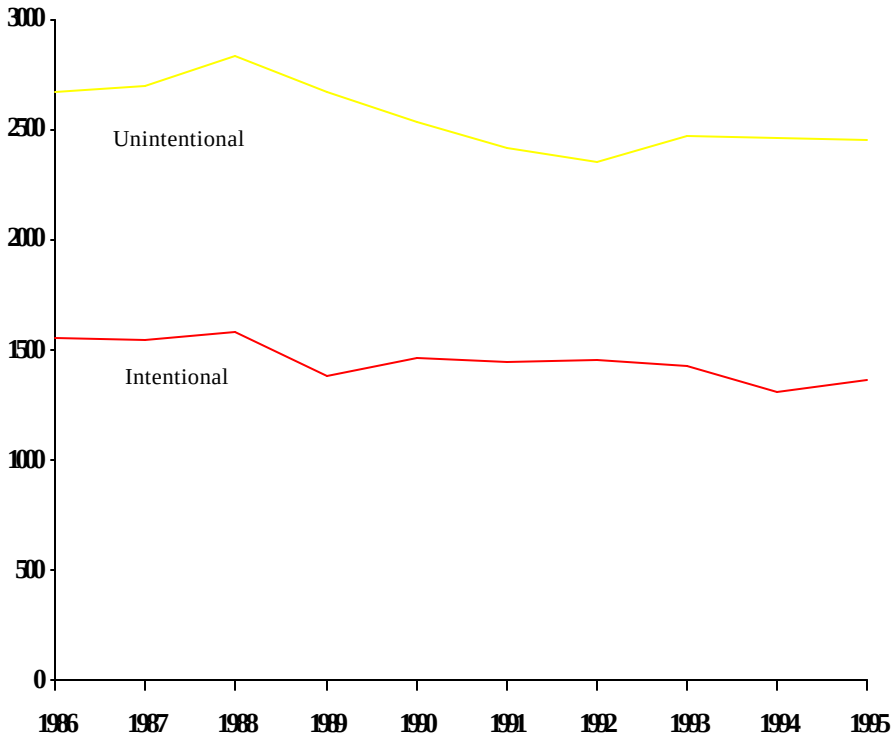
3. Is the number of injuries to the elderly going up or down?

Fatal Injuries. Both unintentional and intentional fatal injuries dropped slightly over the 11-year period, 1985-1995 (Figure A4). Unintentional injuries (such as motor vehicle mishaps and drowning) fell unevenly from 2,751 in 1985 to 2,449 in 1995. The average annual percentage decline during the 11-year period was 1.1 percent. Unintentional injuries fell for all age groups (55-64 by 19%, 65-74 by 18%, and 75-84 by 7%), except the 85 years and over group, which experienced a seven percent increase (data not shown).

Intentional fatal injuries (mostly suicides and homicides) fell from 1,505 in 1985 to 1,367 in 1995 (Figure A4), with the average annual percentage decline being 1.1 percent. (For trend data on

suicide and homicide, turn to the special topics, Section B, of this report.) All groups experienced a decrease (55-64 by 12%, 65-74 by 22%) or no change (75-84) except the 85 and over group, with a 56 percent increase, (data not shown). In sum, the oldest group of Californians experienced an increase in both unintentional and intentional fatal injuries, despite the general decline across the elderly population.

Figure A4. Intentional vs. Unintentional Fatal Injuries, California Residents Age 55 and Over, 1985-1995

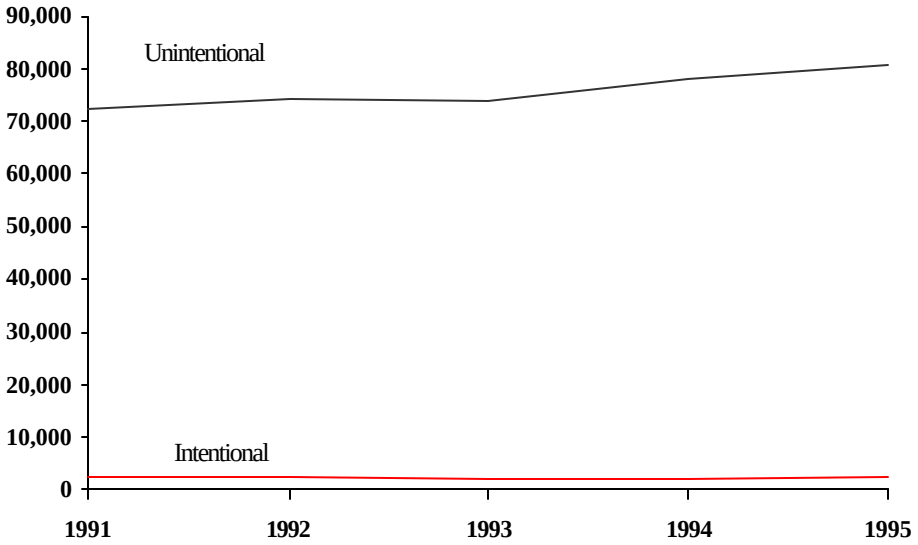


Note: Figure does not include late effects, legal intervention/war, and fatal injuries of undetermined intent.
Source: CA Department of Health Services, death records.

Nonfatal Injuries. Nonfatal injuries rose during the five-year period, 1991-1995. Unintentional injuries climbed fairly consistently from 72,609 in 1991 to 80,892 in 1995, a 2.8 percent average annual increase (Figure A5). Only the 55-64 age group experienced a decline (5%), while unintentional injuries increased for the other age groups (65-74 by 6%, 75-84 by 15%, and 85 and over by 25%) (data not shown).

Although the trend for nonfatal intentional injuries appears flat in Figure A5, the numbers rose from 2,334 in 1991 to 2,500 in 1995, a 2.1 percent average annual increase. Nonfatal intentional injuries increased for the 55-64 age group (by 9%), 75-84 age group (by 13%), and 85 and over age group (by 15%), but fell slightly for the 65-74 age group (by 1%) (data not shown). The 85 and over age group experienced the largest increases in both nonfatal unintentional and intentional injuries over the four-year period.

Figure A5. Intentional and Unintentional Nonfatal Injuries, California Residents Age 55 and Over, 1991-1995



Note: Figure does not include late effects, legal intervention/war, and nonfatal injuries of undetermined intent.

Source: CA Office of Statewide Health Planning and Development, hospital records.

4. Are older males more likely to be injured than older females?

Fatal Injuries. Males are more than twice as likely to sustain a fatal injury than females (Table A3). The rates climb with advancing age for both sexes. Comparing the 55-64 years age group to the 85+ years age group, fatal injury rates were four times higher for males and five times higher for females. Also, males have higher rates for all specified causes of injury. Figure A6 graphically illustrates the higher rates for males than females across the top five

causes of injury. The largest difference is for suicide, with the male rate nearly four times higher than the female rate.

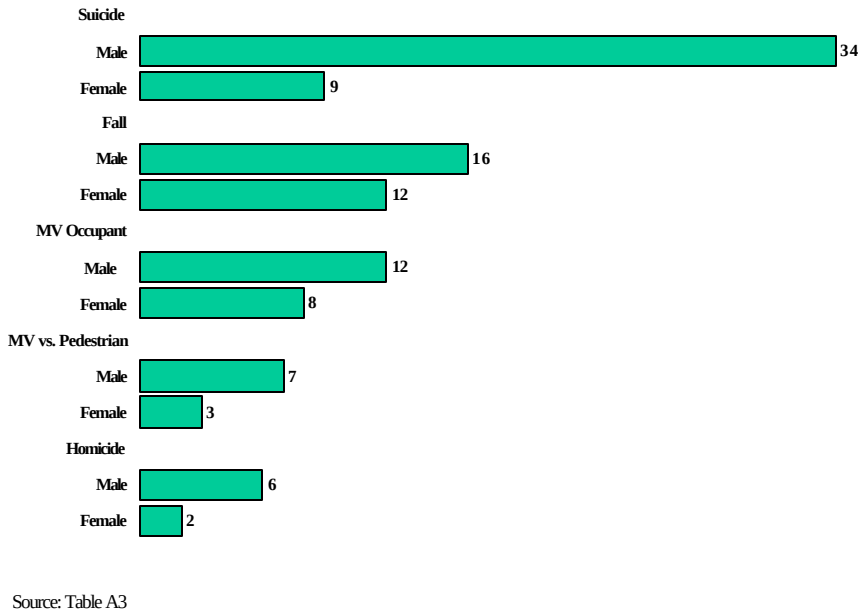
Table A3. Fatal Injury Rates (per 100,000) by Leading Cause of Injury, Sex, and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
All Injuries	**97**	**45**	**74**	**28**	**78**	**34**	**143**	**60**	**297**	**140**
[Number]	[2,470]	[1,446]	[836]	[328]	[679]	[366]	[641]	[404]	[314]	[348]
Suicide	34	9	26	9	29	8	56	8	75	12
Fall	16	11	5	*	10	5	28	17	113	71
MV Occupant	12	8	9	6	12	6	19	11	24	9
MV vs. Pedestrian	7	3	5	3	5	3	11	5	18	5
Homicide	6	2	8	2	4	2	*	3	*	*
Poisoning, Unintentional	4	2	7	3	*	*	*	*	*	*
Fire/Burn	2	2	2	*	2	*	*	*	*	*
Suffocation, Unintentional	2	2	*	*	*	*	*	*	*	*
Unspecified	1	2	*	*	*	*	*	*	*	17
Drowning/Submersion	2	1	2	*	*	*	*	*	10	*
All Other	11	3	9	2	10	3	14	4	19	8

Note: Table shows the top 10 causes of injury, in descending order of the total of the All age groups column.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population.

Figure A6. Top three Causes of Fatal Injury Rates (per 100,000) by Age Group, California Residents Age 55 and Over, 1995



Source: Table A3

Nonfatal Injuries. In contrast to fatal injuries, females are more likely to sustain a nonfatal injury requiring hospitalization (Table A4). Only the rate for males in the 55-64 group was higher than for females. Although males have higher rates for a majority of injuries across all age groups, females have higher rates in four of the five top nonfatal injuries (Figure A7). For falls, the predominant nonfatal injury, the rate for females was nearly double the rate for males. Only for car crash occupant injuries did the rate for males exceed that for females (Figure A7).

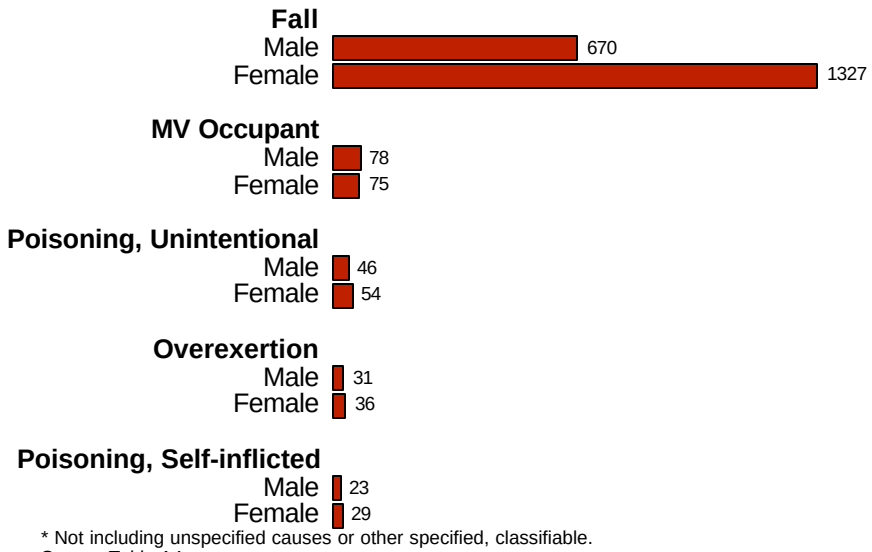
Table A4. Nonfatal Hospitalized Injury Rates (per 100,000) by Leading Cause of Injury, Sex, and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
All Injuries	**1,155**	**1,759**	**639**	**576**	**945**	**1,171**	**2,009**	**2,958**	**4,746**	**6,740**
[Number]	[29,464]	[56,174]	[7,183]	[6,866]	[8,274]	[12,633]	[8,982]	[19,966]	[5,025]	[16,709]
Fall	670	1327	231	300	502	780	1375	2363	3742	5828
MV Occupant	78	75	62	55	72	75	112	101	157	94
Unspecified	65	80	36	28	59	59	104	133	242	276
Poisoning, Unintentional	46	54	33	35	44	54	69	73	103	97
Other Specified, Classifiable	40	38	32	22	38	37	52	51	95	82
Overexertion	31	36	28	23	28	33	42	49	54	75
Self-Inflicted	23	29	22	35	20	24	29	28	48	29
Assault	29	10	37	8	22	9	21	12	35	18
Struck By Object	20	16	18	8	19	13	21	22	32	49
MV vs. Pedestrian	18	17	15	12	17	18	25	21	26	25
All Other	135	77	125	51	125	70	159	103	212	167

Note: Table shows the top 10 causes of injury, in descending order of the total of the All age groups column. Table does not include two cases with sex unknown: a 75-84 admitted because of a fall and an 85+ year old admitted because of overexertion.

Source: California Office of Statewide Health Planning and Development, hospital discharge records and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Figure A7. Top Five* Causes of Nonfatal Hospitalized Injury, Rates (per 100,000) by Sex, California Residents Age 55 and Over, 1995



* Not including unspecified causes or other specified, classifiable.
Source: Table A4.

5. Are older residents of some California counties more at risk of injury than others?

Fatal and Nonfatal Injuries. Tables A5 and A6 present injury rates by county of residence. The tables are organized to make it easy to look up injury rates for specific counties. The left-hand panel gives the usual listing of counties in alphabetic order. The middle panel shows the counties by number of injuries, from high to low. For example, Los Angeles County has the largest numbers (950 fatal injuries and 24,050 nonfatal injuries), and Alpine has the smallest

(zero fatal and one nonfatal injury). In the right-hand panel, counties are listed according to the size of the injury rate. You can compare the rate for a county to adjacent counties, counties of comparable size, and to the statewide rate (68.2 for fatal injuries and 1,490.7 for nonfatal injuries).

Table A5. Fatal Injury Rates (per 100,000) by County of Residence,
California Residents Age 55 and Over, 1995

Listed Alphabetically			*Listed by Number*			*Listed by Rate*		
	Number	Rate		Number	Rate		Number	Rate
Statewide	**3,916**	**68**	**Statewide**	**3,916**	**68**	Lake	25	139
Alameda	169	70	Los Angeles	950	61	Mendocino	22	119
Alpine	0	*	San Diego	307	66	Madera	24	114
Amador	4	*	Orange	245	55	Napa	31	107
Butte	45	87	Riverside	208	74	Shasta	39	104
Calaveras	12	*	San Bernardino	174	74	Imperial	23	101
Colusa	5	*	Alameda	169	70	San Luis Obispo	47	92
Contra Costa	97	57	San Francisco	161	91	Tulare	56	92
Del Norte	5	*	Sacramento	159	77	Stanislaus	67	91
El Dorado	25	82	Santa Clara	138	51	San Francisco	161	91
Fresno	86	68	Contra Costa	97	57	Butte	45	87
Glenn	3	*	Kern	89	86	Kern	89	86
Humboldt	21	84	San Mateo	87	59	San Joaquin	81	85
Imperial	23	101	Fresno	86	68	Yolo	21	85
Inyo	10	*	Ventura	85	68	Humboldt	21	84
Kern	89	86	San Joaquin	81	85	Merced	26	83
Kings	8	*	Stanislaus	67	91	El Dorado	25	82
Lake	25	139	Tulare	56	92	Placer	34	81
Lassen	3	*	Sonoma	53	61	Sacramento	159	77
Los Angeles	950	61	San Luis Obispo	47	92	San Bernardino	174	74
Madera	24	114	Santa Barbara	46	59	Riverside	208	74
Marin	36	69	Butte	45	87	Solano	40	71
Mariposa	5	*	Monterey	41	68	Alameda	169	70
Mendocino	22	119	Solano	40	71	Marin	36	69
Merced	26	83	Shasta	39	104	**Statewide**	**3916**	**68**
Modoc	1	*	Marin	36	69	Monterey	41	68
Mono	1	*	Placer	34	81	Fresno	86	68
Monterey	41	68	Napa	31	107	Ventura	85	68
Napa	31	107	Merced	26	83	San Diego	307	66
Nevada	14	*	El Dorado	25	82	Sonoma	53	61
Orange	245	55	Lake	25	139	Los Angeles	950	61
Placer	34	81	Madera	24	114	Santa Barbara	46	59
Plumas	7	*	Imperial	23	101	San Mateo	87	59
Riverside	208	74	Santa Cruz	23	54	Contra Costa	97	57
Sacramento	159	77	Mendocino	22	119	Orange	245	55
San Benito	6	*	Humboldt	21	84	Santa Cruz	23	54
San Bernardino	174	74	Yolo	21	85	Santa Clara	138	51
San Diego	307	66	Nevada	14	*	Nevada	14	*
San Francisco	161	91	Calaveras	12	*	Calaveras	12	*
San Joaquin	81	85	Siskiyou	11	*	Siskiyou	11	*
San Luis Obispo	47	92	Inyo	10	*	Inyo	10	*
San Mateo	87	59	Sutter	10	*	Sutter	10	*
Santa Barbara	46	59	Tehama	9	*	Tehama	9	*
Santa Clara	138	51	Kings	8	*	Kings	8	*
Santa Cruz	23	54	Yuba	8	*	Yuba	8	*
Shasta	39	104	Plumas	7	*	Tuolumne	7	*
Sierra	0	*	Tuolumne	7	*	Plumas	7	*
Siskiyou	11	*	San Benito	6	*	Trinity	6	*
Solano	40	71	Trinity	6	*	San Benito	6	*
Sonoma	53	61	Colusa	5	*	Colusa	5	*
Stanislaus	67	91	Del Norte	5	*	Mariposa	5	*
Sutter	10	*	Mariposa	5	*	Del Norte	5	*
Tehama	9	*	Amador	4	*	Amador	4	*
Trinity	6	*	Glenn	3	*	Lassen	3	*
Tulare	56	92	Lassen	3	*	Glenn	3	*
Tuolumne	7	*	Modoc	1	*	Modoc	1	*
Ventura	85	68	Mono	1	*	Mono	1	*
Yolo	21	85	Alpine	0		Alpine	0	*
Yuba	8	*	Sierra	0	*	Sierra	0	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Table A6. Nonfatal Hospitalized Injury Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

Listed Alphabetically			*Listed by Number*			*Listed by Rate*		
	Number	Rate		Number	Rate		Number	Rate
Statewide	**85,640**	**1,491**	**Statewide**	**85,640**	**1,491**	Napa	629	2,162
Alameda	3,725	1,547	Los Angeles	24,050	1,547	Trinity	75	2,121
Alpine	1	*	San Diego	7,308	1,563	Yuba	230	2,088
Amador	170	1,710	Orange	7,122	1,610	Humboldt	495	1,989
Butte	726	1,400	Riverside	4,109	1,454	Sutter	294	1,864
Calaveras	176	1,564	Alameda	3,725	1,547	Stanislaus	1297	1,771
Colusa	50	1,357	Sacramento	3,242	1,577	Tuolumne	248	1,726
Contra Costa	2,377	1,386	San Bernardino	3,227	1,374	Amador	170	1,710
Del Norte	75	1,243	Santa Clara	3,023	1,111	Lake	307	1,709
El Dorado	414	1,353	San Francisco	2,788	1,582	Sonoma	1452	1,680
Fresno	1,576	1,243	Contra Costa	2,377	1,386	Mendocino	311	1,680
Glenn	79	1,387	San Mateo	1,952	1,321	Placer	698	1,660
Humboldt	495	1,989	Ventura	1,708	1,358	Nevada	408	1,636
Imperial	303	1,334	Fresno	1,576	1,243	Orange	7122	1,610
Inyo	60	1,088	Kern	1,528	1,473	San Francisco	2788	1,582
Kern	1,528	1,473	Sonoma	1,452	1,680	Sacramento	3242	1,577
Kings	222	1,408	San Joaquin	1,362	1,426	Calaveras	176	1,564
Lake	307	1,709	Stanislaus	1,297	1,771	San Diego	7308	1,563
Lassen	52	956	Santa Barbara	1,114	1,441	Shasta	585	1,557
Los Angeles	24,050	1,547	Tulare	904	1,491	San Luis Obispo	787	1,548
Madera	199	946	Monterey	881	1,462	Alameda	3725	1,547
Marin	730	1,401	San Luis Obispo	787	1,548	Los Angeles	24050	1,547
Mariposa	55	1,135	Butte	730	1,401	**Statewide**	**85640**	**1,491**
Mendocino	311	1,680	Marin	726	1,400	Tulare	904	1,491
Merced	383	1,224	Placer	698	1,660	Kern	1528	1,473
Modoc	25	898	Napa	629	2,162	Monterey	881	1,462
Mono	8	*	Santa Cruz	616	1,087	Riverside	4109	1,454
Monterey	881	1,462	Solano	612	1,434	Santa Barbara	1114	1,441
Napa	629	2,162	Shasta	585	1,557	Santa Cruz	612	1,434
Nevada	408	1,636	Humboldt	495	1,989	San Joaquin	1362	1,426
Orange	7,122	1,610	El Dorado	414	1,353	Yolo	350	1,409
Placer	698	1,660	Nevada	408	1,636	Kings	222	1,408
Plumas	85	1,380	Merced	383	1,224	Marin	730	1,401
Riverside	4,109	1,454	Yolo	350	1,409	Butte	726	1,400
Sacramento	3,242	1,577	Mendocino	311	1,680	Glenn	79	1,387
San Benito	85	1,108	Lake	307	1,709	Contra Costa	2377	1,386
San Bernardino	3,227	1,374	Imperial	303	1,334	Plumas	85	1,380
San Diego	7,308	1,563	Sutter	294	1,864	San Bernardino	3227	1,374
San Francisco	2,788	1,582	Tuolumne	248	1,726	Ventura	1,708	1,358
San Joaquin	1,362	1,426	Yuba	230	2,088	Colusa	50	1,357
San Luis Obispo	787	1,548	Kings	222	1,408	Siskiyou	162	1,354
San Mateo	1,952	1,321	Madera	199	946	El Dorado	414	1,353
Santa Barbara	1,114	1,441	Tehama	181	1,231	Imperial	303	1,334
Santa Clara	3,023	1,111	Calaveras	176	1,564	San Mateo	1,952	1,321
Santa Cruz	612	1,434	Amador	170	1,710	Del Norte	75	1,243
Shasta	585	1,557	Siskiyou	162	1,354	Fresno	1,576	1,243
Sierra	9	*	Plumas	85	1,380	Tehama	181	1,231
Siskiyou	162	1,354	San Benito	85	1,108	Merced	383	1,224
Solano	616	1,087	Glenn	79	1,387	Mariposa	55	1,135
Sonoma	1,452	1,680	Del Norte	75	1,243	Santa Clara	3,023	1,111
Stanislaus	1,297	1,771	Trinity	75	2,121	San Benito	85	1,108
Sutter	294	1,864	Inyo	60	1,088	Inyo	60	1,088
Tehama	181	1,231	Mariposa	55	1,135	Solano	616	1,087
Trinity	75	2,121	Colusa	52	956	Lassen	52	956
Tulare	904	1,491	Lassen	50	1,357	Madera	199	946
Tuolumne	248	1,726	Modoc	25	898	Modoc	25	898
Ventura	1,708	1,358	Sierra	9	*	Sierra	9	*
Yolo	350	1,409	Mono	8	*	Alpine	1	*
Yuba	230	2,088	Alpine	1	*	Mono	8	*

* Rates were not computed for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital discharge records and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

6. How prominent is Medicare as a payer for the first hospital admission following an injury?

All the major expected payers for hospitalized injuries are displayed in Table A7. When seniors who are 65 years and over receive Medicare through a health maintenance organization (HMO), the hospital reports this as a Medicare discharge. In cases with dual coverage (like Medicare and HMO), the payer with the greatest portion of the bill is reported. Medicare was expected to pay for 63,800 or 72 percent of hospitalized injuries, with HMO's a distant second (11%). Medicare as payer jumps from 16 percent for the 55-64 age group to 86 percent for the 85 and over group, as Figure A8 shows. Conversely, all the other major payers are prominent for the 55-64 age group and diminish in importance for the older groups.

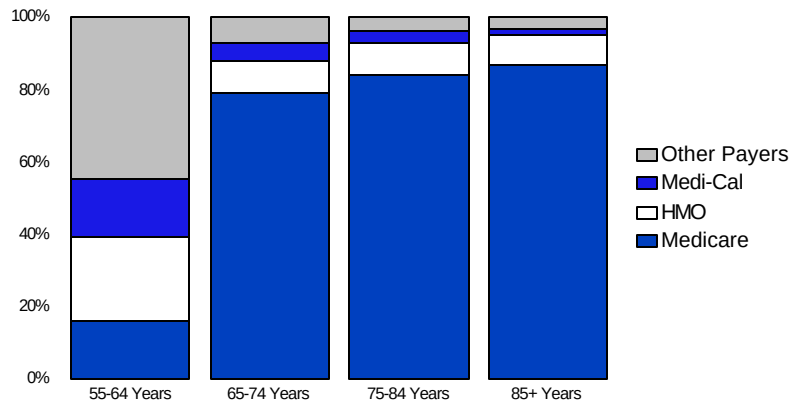
Table A7. Expected Principal Source of Payment for Hospitalized Injuries by Age
Percentage Distribution, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
ALL Payers	**88,696**	**100%**	**14,360**	**100%**	**21,605**	**99%**	**29,994**	**99%**	**22,737**	**99%**
Medicare	63,800	72	2,309	16	16,819	78	25,041	83	19,631	86
HMO	9,687	11	3,361	23	2,024	9	2,562	9	1,740	8
Medi-Cal	4,804	5	2,272	16	1,014	5	978	3	540	2
Private Insurance	3,495	4	1,812	13	743	3	621	2	319	1
PPO*	2,956	3	1,735	12	493	2	444	1	284	1
Self-Pay	1,641	2	996	7	221	1	102	0	178	1
All Other	2,313	3	1,875	13	291	1	246	1	45	0

* Preferred provider organization (PPO) refers to a network of independent physicians, hospitals, and other health care providers who contract with an insurance entity to provide care at discount rates.

Source: California Office of Statewide Health Planning and Development, hospital discharge records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Figure A8. Major Expected Payers for Fatal and Hospitalized Injuries by Age Group, Percentage Distribution
California Residents Age 55 and Over, 1995



Source: Table A7.

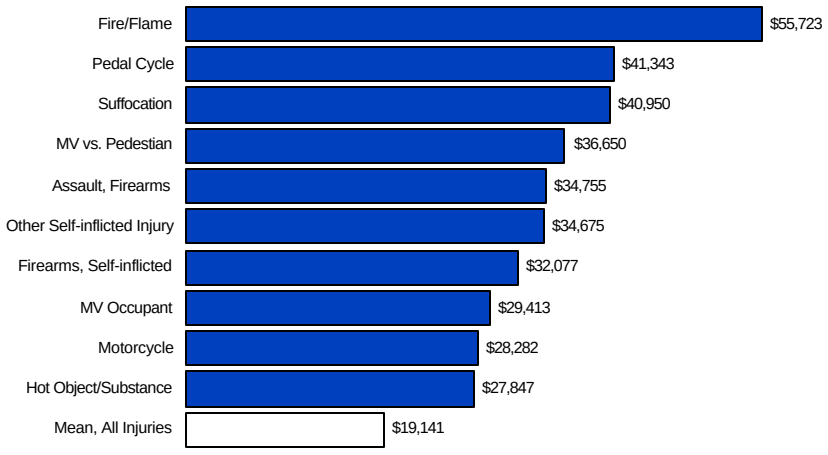
*7. How much do injuries to older Californians cost?**

The hospital charges for injuries serious enough to cause hospitalization amounted to $1.7 billion for 1995 (Table A8). The 75-84 age group had the largest portion of this total (34%) followed by the 65-74 age group (26%), the 85 and over age group (23%), and the 55-64 age group (17%) (Appendix Tables A3-A6). Contrary to our expectations, the 75-84 group had the most charges (*not* the 85 and over group), followed by the 65-74 group.

The amount of hospital charges for each cause of injury is given in Table A8. Again, these data capture acute care only (not skilled nursing facility (SNF) or rehabilitation services, which are reported separately). Falls represent the largest share of all hospital charges ($1.1 billion or 65% of charges). For the age groups, falls are 40 percent of hospital charges for patients 55-64, increasing to 56 percent for those 65-74, 72 percent for those 75-84, and 84 percent for those 85 and over (Appendix Tables A3-A6). Therefore, falls are the dominant injury cost for older Californians.

Average (mean) charges are $19,141 for all injuries among seniors, with some variation by age group (Appendix Tables A3-A6). The most costly injuries are those caused by fire/flame ($55,723), pedal cycle ($41,343), and suffocation ($40,950) (Figure A9). The injuries with the lowest mean charges are bites and stings ($10,862) and overexertion ($12,845).

Figure A9. Top 10 Injuries with Highest Mean Hospital Charges, California Residents Age 55 and Over, 1995



Source: Table A8.

* Hospital charges ? the amount billed (but not necessarily paid)? cover the patients' first admission to acute care (only) for the injury, and are the only available part of injury costs to report. We have imputed hospital charges for 3,747 cases (4%) where hospital charges were not reported or unknown. The number of injuries given in Table A8 and all subsequent tables are not comparable to any other data in this report because they include 3,056 (3%) who died in the hospital. We include them here so we can account for all hospital charges.

Table A8. Hospital Charges and Length of Stay (in Days) by Cause of Injury, California Residents Age 55 and Over, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Injuries	**88,696**	**$19,141**	**$1,697,716,655**	**7.3**	**651,341**
Fall	61,385	$17,997	$1,104,760,850	7.3	449,200
MV Traffic	6,334	$30,495	$193,156,136	6.6	41,630
» Occupant	4,570	$29,413	$134,418,282	5.9	26,984
» Pedestrian	1,088	$36,650	$39,874,715	8.1	8,860
» Motorcyclist	227	$28,282	$6,420,016	6.3	1,438
» Pedal Cyclist	110	$41,343	$4,547,744	8.2	902
» Other MV	49	$20,120	$985,886	5.1	251
» Unspecified	290	$23,826	$6,909,493	11.0	3,195
Unspecified	3,976	$18,930	$75,263,823	9.6	38,235
Poisoning	2,995	$13,334	$39,934,012	4.3	12,991
Late Effects	2,148	$20,249	$43,495,921	10.3	22,051
Overexertion	1,971	$12,845	$25,317,140	5.0	9,768
Self-inflicted	1,642	$16,232	$26,653,106	4.8	7,908
» Poisoning	1,289	$13,184	$16,993,816	4.1	5,311
» Cutting & Piercing	147	$19,635	$2,886,398	7.5	1,096
» Firearms	78	$32,077	$2,502,027	4.8	377
» Hanging	11	*	$213,880	*	78
» Other Self-inflicted	117	$34,675	$4,056,985	8.9	1,046
Natural Environmental	1,098	$13,862	$15,220,571	4.6	5,101
» Bites & Stings	528	$10,862	$5,735,076	4.0	2,090
» Other Environmental	570	$16,641	$9,485,495	5.3	3,011
Struck By Object	1,027	$18,520	$19,019,673	13.3	13,655
Assault	1,020	$24,906	$25,404,442	6.7	6,828
» Fight	315	$19,139	$6,028,845	6.9	2,169
» Firearms	119	$34,755	$4,135,820	6.5	779
» Cutting & Piercing	108	$22,044	$2,380,774	4.3	469
» Hanging	4	*	$466,281	*	43
» Poisoning	3	*	$25,775	*	6
» Other Assault	471	$26,257	$12,366,947	7.2	3,362
Fire/Burn	784	$38,798	$30,417,972	14.6	11,424
» Hot Object/Substance	476	$27,847	$13,255,242	8.6	4,116
» Fire/Flame	308	$55,723	$17,162,730	23.7	7,308
Other Specified, Classifiable	966	$22,430	$21,667,575	6.9	6,631
Cutting & Piercing, Uninten.	687	$15,183	$10,430,822	4.8	9
Suffocation	676	$40,950	$27,682,201	11.4	7,719
Transport, non-MV	613	$21,507	$13,184,027	7.1	4335
Other Specified	435	$20,404	$8,875,795	8.1	3,530
Pedal Cyclist, non-MV	348	$18,420	$6,410,236	4.5	1,559
Machinery	246	$17,074	$4,200,103	6.2	1,513
Undetermined	146	$16,448	$2,401,430	19.4	2,829
Pedestrian, non-MV	110	$22,245	$2,446,936	5.3	582
Legal Intervention/War	18	*	$378,644	*	191
Firearm, Unintentional	37	$18,083	$669,075	5.4	201
Drowning, Submersion	34	$21,358	$726,165	3.3	112

* Means not shown for fewer than 20 cases.

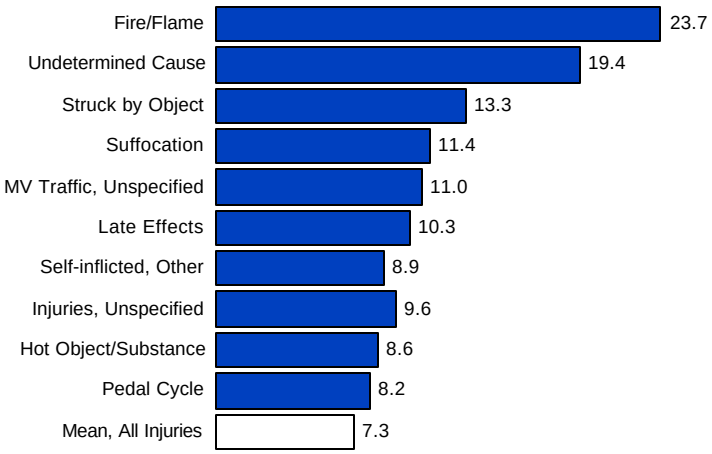
Source: California Office of Statewide Health Planning and Development, hospital discharge records.

8. How long do older injury victims stay in the hospital?

Overall, older Californians injured in 1995 spent a total of 651,341 days in the hospital? that's equivalent to 1,785 years! (Table A8). The average stay is 7.3 days, ranging from 6.9 days for the 55-64 age group to 7.6 days for the oldest group (Appendix Tables A3-A6).

Given the enormity of falls as a cause of injury, it is not surprising the average stay for falls is equivalent to the average stay across all injuries (7.3 days). We note that average length of stay may be artificially low for some fall cases. For example, elders with a hip fracture may be transferred out of acute care to an SNF for rehabilitation services—this care would be charged for the SNF, not acute care. Injuries causing the longest hospital stays are highlighted in Figure A10. The 308 elderly patients injured by fire or flame experienced the longest average hospital stays, 23.7 days.

Figure A10. Top 10 Injuries with Longest Mean Hospital Stays (in Days), California Residents Age 55 and Over, 1995



Source: Table A8.

Falls are the predominant cause of hospitalization and account for 449,200 days or 70 percent of all days (Table A8). Falls account for nearly half of the hospital days for the 55-64 group, 60 percent for the 65-74 group, and three-quarters for those 75 and over (Appendix Tables A3-A6). The monumental and deplorable impact of falls on the elderly cannot be sufficiently emphasized. (See our Special Topic on falls for more data and analyses.)

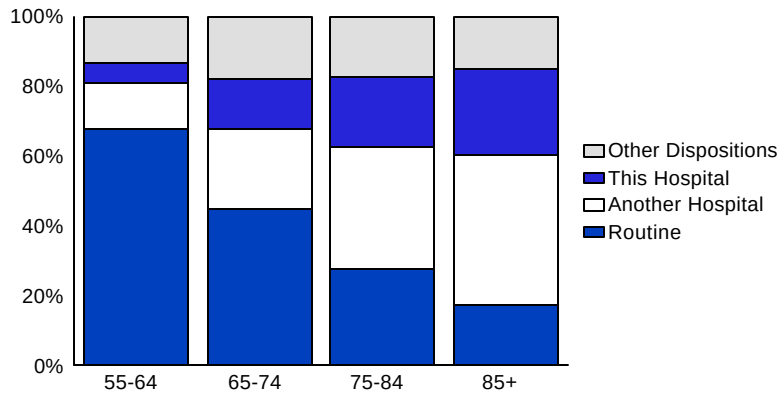
9. Is the outcome of hospitalization for injury favorable or unfavorable among the elderly?

"Outcome" can be inferred from disposition at discharge, which is shown in Table A9 and illustrated in Figure A11. The most favorable outcome is a routine discharge where the patient is discharged to his/her home. Only 35 percent had such a favorable outcome, with the percentages sharply decreasing with advancing age.

The remaining 65 percent had an unfavorable outcome, with transfers to another hospital (31%) and within the same hospital (17%) being the two most common. The percentage transferred increase with advancing age. Dying in the hospital, the most unfavorable outcome of all, is a minor proportion of all dispositions (3%). (Although generally true, there are exceptions to our

outcome analysis. For example, an elder may be discharged home with limited prospects for rehabilitation—an unfavorable outcome. Similarly, a patient may be discharged to an SNF to undergo rehabilitation, and then return home reasonably functional—a favorable outcome.)

Figure A11. Disposition at Discharge for Hospitalized Injuries by Age Group, Percentage Distribution, California Residents Age 55 and Over, 1995



Source: Table A9.

Table A9. Disposition at Discharge for Nonfatal Hospitalized Injuries by Age
Percentage Distribution, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
ALL Dispositions	**88,695**	**99%**	**14,359**	**99%**	**21,605**	**100%**	**29,994**	**100%**	**22,737**	**99%**
Routine	31,471	35	9,685	67	9,699	45	8,324	28	3,763	17
Another Hospital	27,252	31	1,931	13	5,007	23	10,467	35	9,847	43
Within Same Hospital	15,388	17	874	6	3,022	14	6,045	20	5,447	24
Home Health Service	9,624	11	1,218	8	2,792	13	3,486	12	2,128	9
Died	3,056	3	311	2	698	3	1,045	3	1,002	4
Other Dispositions	995	1	224	2	249	1	310	1	212	1
Residential Care Facility	909	1	116	1	138	1	317	1	338	1

Note: One case with disposition unknown in 55-64 age group not included.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

10. To what extent do hospital charges and length of stay vary for the different discharge dispositions?

A routine discharge to one's home results in the lowest average hospital charges and shortest average stay (Table A10). This finding was true for all of the age groups, except the 65-74 age group (Appendix Tables A7-A10).

Dying in the hospital is associated with the largest average charges ($42,233) and the longest average stay (17.5 days) for the injured elderly population (Table A10). Unexpectedly, average stay, an obvious factor in average charges, did not climb steadily with age. Rather, the 65-74

age group experienced the longest stays (23.6 days) and the 55-64 age group had the largest average charges ($53,960) (Appendix Tables 7-10).

Elderly who died in the hospital had more than their share of charges and days: The three percent who died account for eight percent of both total hospital charges and days. This overrepresentation occurred across all age groups (Appendix Tables 7-10).

Table A10. Hospital Charges and Length of Stay for Nonfatal Hospitalized Injuries by Disposition at Discharge, California Residents Age 55 and Over, 1995.

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
ALL Dispositions	**88,695**	**$19,141**	**$1,697,699,529**	**7.3**	**651,334**
Routine	31,471	$14,125	$444,514,747	4.6	143,347
Another Hospital	27,252	$22,091	$602,013,776	7.9	215,235
Within Same Hospital	15,388	$20,675	$318,145,895	9.9	152,833
Home Health Service	9,624	$17,884	$172,112,815	7.1	67,884
Died	3,056	$42,233	$129,064,098	17.5	53,609
Other Dispositions	995	$17,997	$17,907,162	9.7	9,632
Residential Care Facility	909	$15,337	$13,941,036	9.7	8,794

Note: One case with disposition unknown in 55-64 age group not included.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Special Topic: Assault and Homicide

Violence, a serious problem for elders, has been called "alien to the American ideal" by the United States (U.S.) House of Representatives Select Committee on Aging.[1] Compared to their counterparts in other industrialized countries, elders in the United States have higher homicide rates.[2-3] In addition to homicide, elder abuse includes nonfatal assault and subtler forms (like neglect), which are sometimes hard to identify. Elder abuse can be masked by chronic conditions, and the abused elderly are often ashamed to admit being mistreated by their children and others entrusted with their care.[4] Estimates of the number of abused persons 65 years and over range from one million[4-5] to two million each year.[6] The absolute size of the problem will likely grow as the U.S. population grows older.[4]

Homicide trends present a mixed picture. For persons aged 55-64 and 65-74 in the U.S., injury homicide rates (per 100,000) have fluctuated but declined from 1969 to 1988. However, numbers remain large. For the oldest age group, 75 years and over, homicide rates have actually increased.[2] The most recent data for California are more positive. For Californians 60 years and over, the homicide rate fell 53.6 percent from 1988 to 1998, compared to a 38.1 percent decline for the total population.[7]

Although elder homicide is a serious problem, seniors have lower homicide rates than younger people.[8] The special characteristics of elders seem to put them at increased risk for abuse: dependency,[9] functional disability, minority status, older age, and poor social support.[10] Their greater frailty make assaults and other injuries more lethal.[11] Elders perceive themselves at risk and may exercise extreme caution? to the point of self-imposed "imprisonment."[12] For homicide specifically, elders most at risk are females and black males (but racial differences decrease when the data are adjusted for socioeconomic status),[13] people older than 55 years,[12] and those keeping guns in their homes.[3]

But there is still much we do not know about the causes and consequences of elder abuse.[4] For example, violence perpetrated by partners (i.e., domestic violence), and family members living with and caring for elders, need to be investigated.

Assault and Homicide Data†

There were 983 assault injuries, nearly 19 each week, among California residents 55 years of age or older in 1995 (Table B1.1). An unarmed fight was the most common mechanism of nonfatal assault (32%), followed by struck by an object (17%), gun shot (11%), and a cutting and piercing instrument (10%) (Table B1.1).

† We define nonfatal assaults by identifying hospital discharge records where the external cause of injury is coded "homicide and injury purposively inflicted by other persons" (ICD-9 codes E960.0-E968.9).

Table B1.1. Assault by Mechanism of Assault, California Residents Age 55 and Over, 1995

	Number	Percent
All Assault	**983**	**100**
Unarmed Fight	311	32
Striking*	171	17
Firearms, Total	109	11
» Hand Gun	38	4
» Shot Gun	9	1
» Hunting Rifle	1	0
» Unspecified Firearm	61	6
Cutting & Piercing	103	10
Rape	7	1
Hanging & Suffocation	3	0
All Other	114	12
Unknown	165	17

* By blunt or thrown object.

Source: California Office of Statewide Health Planning and Development, hospital records.

Data on fatal assaults? homicides? are derived from computerized death certificates where the underlying cause of death consists of the same code series used for nonfatal assault, above. Among older California residents in 1995, 219 were intentionally killed, over four people each week. Guns were the most common mechanism (42%), with cutting and piercing instrument a distant second (19%) (Table B1.7). Since e-codes do not identify perpetrators, we look at the Linked Homicide File, which does so for the perpetrator of the homicides. This file consists of death records from the Department of Health Services (DHS) and supplemental homicide reports from the California Department of Justice for 1990-1995. Comparable perpetrator data for nonfatal, hospitalized injuries are not available.

Table B1.7. Homicide by Mechanism of Homicide, California Residents Age 55 and Over, 1995

	Number	Percent
All Assault	**219**	**101**
Firearms, Total	93	43
» Hand Gun	22	10
» Shot Gun	6	3
» Hunting Rifle	0	0
» Unspecified Firearm	65	30
Cutting & Piercing	41	19
Hanging & Suffocation	24	11
Striking*	11	5
All Other	28	13
Unknown	22	10

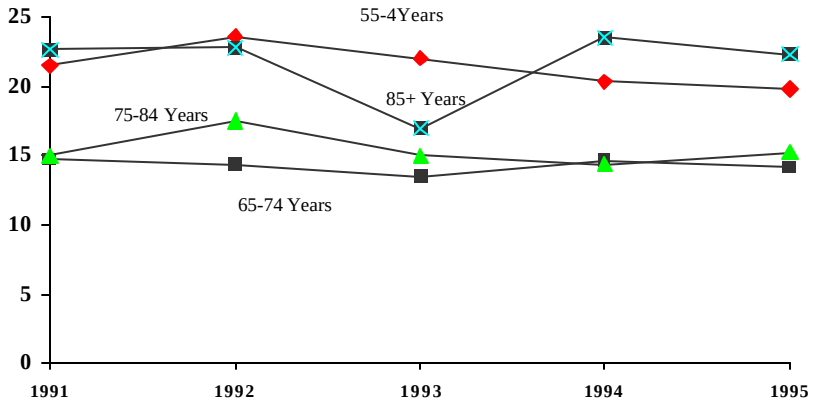
* By blunt or thrown object.

Source: California Department of Health Services, death records.

Nonfatal Assault Trends

Nonfatal assault rates (per 100,000) for the five-year period 1991-1995 appear in Figure B1.1. Across all elder age groups, the average annual rate of decline was 1.1 percent during the period. Beginning at 18 for 1991, rates rose to 19.2 for 1992, and then dropped to 17.1 for 1995 (data not shown). A decline was found only in the large 55-64 age group (average rate decline of 1.8%), since the other age groups registered a small to modest average rate increase. For elders 65 years and over, on average, assault rates rose with advancing age (0.5% for age 65-74, 1.0% for age 75-84, and 2.2% for age 85 and older).

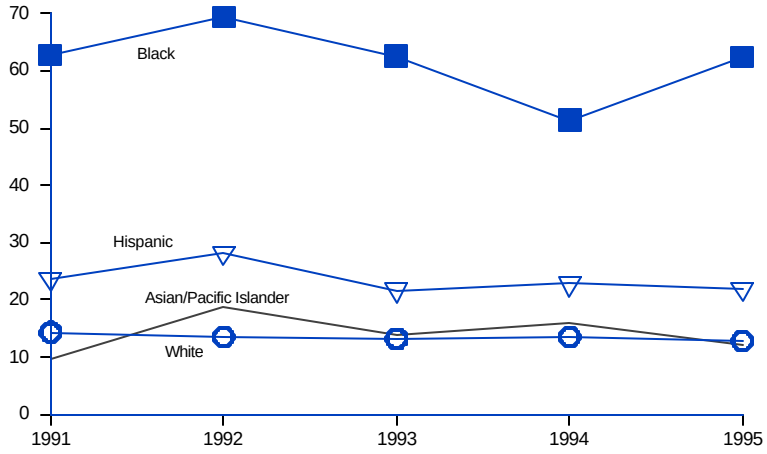
Figure B1.1. Assault Rates (per 100,000) by Age,California Residents Age 55 and Over, 1991-1995



Source: CA Office of Statewide Health Planning and Development, hospital records and CA Department of Finance, 1970-1996 Population Estimates, Race/Ethnic, January 1998.

By race/ethnicity, we see rate declines for whites (-2.7% per year) and Hispanics (-0.4% per year), but blacks had the highest rates and experienced a minor rate increase (1.1% per year, from 62.8 for 1991, rising to 69.4 for 1992, falling two consecutive years to 59.1 for 1994 and then rising to 62.4 for 1995). Asians, by comparison, showed a substantial increase, with a rate increase of 14.3 percent per year (Figure B1.2).

Figure B1.2. Assault Rates (per 100,000) by Race/Ethnicity, California Residents Age 55 and Over, 1991



Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Sex, Age, and Race/Ethnicity Patterns for Nonfatal Assault

Table B1.2 shows demographic risk patterns for elder assault victims. Sex is a strong risk factor, with nearly 7 out of 10 hospitalized patients being male. The male rate is nearly three times that of females, a statistically significant difference. An unarmed fight was the most common mechanism of assault for both males and females, but striking, and cutting and piercing were more characteristic of male victims, as Table B1.3 shows.

Table B1.2. Assault by Sex, Age, Race/Ethnicity, California Residents Age 55 and Over, 1995

	Number	Percent	Rate/100,000	95% Confidence Interval
All Assault	**983**	**100**	**17.1**	**16.0 – 18.2**
Sex				
» Male	680	69	26.7	24.6 - 28.7
» Female	303	31	9.5	8.4 - 10.6
Age Group				
» 55-64 Years	458	47	19.8	18.0 - 21.6
» 65-74 Years	275	28	14.1	12.4 - 15.7
» 75-84 Years	171	17	15.2	13.0 - 17.5
» 85 Years +	79	8	22.3	17.4 - 27.3
Race/Ethnicity				
» White	522	53	12.8	11.7 - 13.9
» Black	197	20	62.4	53.7 - 71.1
» Hispanic	181	18	22.0	18.8 - 25.2
» Asian/Pacific Islander	61	6	12.1	9.1 - 15.2
» Other/Unknown*	22	2	**	**

Note: Percentages may not actually add up to 100 because of independent rounding.

* 12 are other and 10 are unknown.

** Rates were not computed for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Table B1.3. Assault by Mechanism and Sex, California Residents Age 55 and Over, 1995

	Male	Female
All Assault	**100% (680)**	**100% (303)**
Unarmed Fight	32%	31%
Striking*	20%	11%
Firearm	12%	9%
Cutting & Piercing	14%	3%
Other Specified	8%	24%
Unknown	14%	22%

* By blunt or thrown object.

Source: California Office of Statewide Health Planning and Development, hospital records.

Oddly, nonfatal assault rates were significantly higher in the 55-64 and 85 years and over age groups than the other age groups (Table B1.2). Fighting was the most typical mechanism of assault for all age groups, except in the 85 years and over group, where the miscellaneous category Other Specified accounted for 27 percent of the assaults (Table B1.4).

Table B1.4. Assault by Mechanism and Age,
California Residents Age 55 and Over, 1995

	55-64	65-74	75-84	85+
All Assault	**101% (458)**	**100% (275)**	**100% (171)**	**101% (79)**
Unarmed Fight	31%	36%	32%	22%
Striking*	20%	14%	18%	10%
Firearm	14%	11%	5%	8%
Cutting & Piercing	15%	8%	3%	11%
Other Specified	7%	13%	21%	27%
Unknown	14%	18%	21%	23%

* By blunt or thrown object.

Source: California Office of Statewide Health Planning and Development, hospital records.

Race/ethnicity is a strong risk factor. Blacks have the highest rate, almost three times as high as the rate for Hispanics and about five times as high as the rates for whites and Asians (Table B1.2). All rate differences are statistically significant, except that between whites and Asians. Fighting was the most common nonfatal assault mechanism for whites, Hispanics, and Asians; striking was most characteristic of blacks (Table B1.5).

Table B1.5. Assault by Mechanism and Race/Ethnicity
California Residents Age 55 and Over, 1995

	White	Black	Hispanic	Asian
All Assault	**99% (522)**	**100% (197)**	**101% (181)**	**100% (61)**
Unarmed Fight	34%	22%	35%	33%
Striking*	15%	26%	14%	16%
Firearm	7%	16%	15%	18%
Cutting & Piercing	8%	16%	14%	5%
Other Specified	17%	8%	6%	7%
Unknown	18%	12%	17%	21%

* By blunt or thrown object.

Note: Other and unknown race/ethnicity (n=22) not shown in table.

Source: California Office of Statewide Health Planning and Development, hospital records.

Nonfatal Assault County Patterns

Table B1.6 displays rates for hospitalized nonfatal assaults, organized according to patients' county of residence. We display rates for counties with 20 or more hospitalizations for assault. San Francisco County has the highest rate, nearly twice as high as the statewide rate, and nearly four times higher than Santa Clara, which has the lowest rate. Sacramento and San Francisco also have remarkably high assault rates.

Table B1.6. Assault Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**983**	**17.1**			
Alameda	58	24.1	Orange	45	10.2
Alpine	0	*	Placer	4	*
Amador	1	*	Plumas	0	*
Butte	4	*	Riverside	46	16.3
Calaveras	0	*	Sacramento	62	30.2
Colusa	0	*	San Benito	1	*
Contra Costa	21	12.2	San Bernardino	42	17.9
Del Norte	0	*	San Diego	66	14.1
El Dorado	1	*	San Francisco	58	32.9
Fresno	24	18.9	San Joaquin	15	*
Glenn	0	*	San Luis Obispo	2	*
Humboldt	2	*	San Mateo	13	*
Imperial	5	*	Santa Barbara	5	*
Inyo	0	*	Santa Clara	23	8.5
Kern	18	*	Santa Cruz	3	*
Kings	4	*	Shasta	7	*
Lake	1	*	Sierra	0	*
Lassen	0	*	Siskiyou	2	*
Los Angeles	391	25.1	Solano	6	*
Madera	2	*	Sonoma	5	*
Marin	4	*	Stanislaus	2	*
Mariposa	0	*	Sutter	1	*
Mendocino	3	*	Tehama	1	*
Merced	2	*	Trinity	0	*
Modoc	1	*	Tulare	4	*
Mono	0	*	Tuolumne	0	*
Monterey	7	*	Ventura	9	*
Napa	3	*	Yolo	6	*
Nevada	1	*	Yuba	2	*

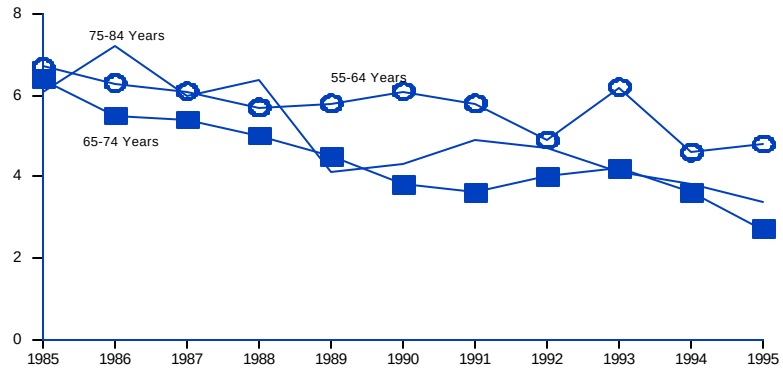
* Rates not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Homicide Trends

Homicide rates (per 100,000) for 1985-1995 appear in Figure B1.3. Homicide has decreased unevenly for all age groups (from 6.5 in 1985 to 3.8 in 1995) during the 11-year period (data not shown). The rate decrease was -5.5 percent per year. By age group, average annual rate declines were -2.9 percent for the 55-64 group, -7.7 percent for the 65-74 group, and -4.4 percent for the 75-84 group. (We do not have enough data to compute a rate change for persons 85 years and over.)

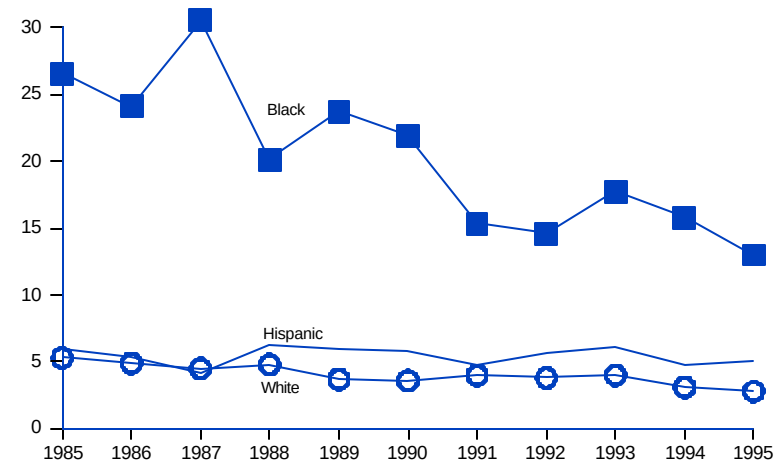
Figure B1.3. Homicide Rates (per 100,000) by Age, California Residents Age 55 and Over, 1985-1995



Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

The average annual drop in homicide rate declined for whites (5.5%) and blacks (4.8%), but increased slightly for Hispanics (1.4%) (Figure B1.4). (Numbers for Asians were less than 20 homicides for 10 of the 11 years so we cannot compute rate change.)

Figure B1.4. Homicide Rates (per 100,000) by Race/Ethnicity, California Residents Age 55 and Over, 1985-1995



Source: California Department of Health Services, death records, and California Department of Finance, 1970-1998 Race/Ethnic Population Estimates, January 1998.

Sex, Age, and Race/Ethnicity Patterns for Homicide

Table B1.8. Homicide by Sex, Age, and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Number	Percent	Rate/100,000	95% Confidence Interval
All Assault	**219**	**100**	**3.8**	**3.3 – 4.3**
Sex				
» Male	142	65	5.6	4.6-6.5
» Female	77	35	2.4	1.9-2.9
Age Group				
» 55-64 Years	111	51	4.8	3.9-5.7
» 65-74 Years	52	24	2.7	1.9-3.4
» 75-84 Years	38	17	3.4	2.3-4.5
» 85 Years +	18	8	*	*
Race				
» White	116	53	2.8	2.3-3.4
» Black	41	19	13.0	9.0-17.0
» Hispanic	42	19	5.1	3.6-6.6
Asian/Pacific Islander	20	9	4.0	2.2-5.7
Other	0	0	NA	NA

Note: Percentages may not actually add up to 100 because of independent rounding.
NA = not applicable.

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

We display 1995 demographic risk patterns for elder homicide in Table B1.8. Sex is a strong risk factor, with nearly two-thirds of the homicide victims being males. The male rate is more than twice that of females, a statistically significant difference. The most common homicide mechanism is firearms for both sexes, with the percentage larger for males than females. The mechanism of strangulation was significant for females, but minor for males (Table B1.9).

Table B1.9. Homicide by Mechanism and Sex, California Residents Age 55 and Over, 1995

	Male	Female
All Homicide	**100% (142)**	**100% (77)**
Firearm	46%	35%
Cutting & Piercing	18%	19%
Hanging	6%	21%
Other Specified	19%	16%
Unknown	11%	9%

Source: California Department of Health Services, death records.

The 55-64 age group had the highest rate, nearly twice as high as that for the age group with the lowest rate, 65-74 years, a statistically significant difference (Table B1.8). Firearms killed a majority of the 55-64 age group, with the proportion falling as age increases. In contrast, the mechanisms of cutting and piercing and hanging generally rose with advancing age (but the numbers for persons 85 years and over are tiny.) (Table B1.10).

Table B1.10. Homicide by Mechanism and Age,
California Residents Age 55 and Over, 1995

	55-64	65-74	75-84	85+
All Homicide	**99% (111)**	**100% (52)**	**100% (38)**	**100% (18)**
Firearm	51%	38%	32%	22%
Cutting & Piercing	14%	23%	26%	17%
Hanging	7%	12%	16%	22%
Other Specified	19%	17%	13%	22%
Unknown	8%	10%	13%	17%

Source: California Department of Health Services, death records.

Race is the strongest risk factor. Blacks have the highest homicide rate, almost five times higher than the rate for whites (with the lowest rate), more than three times higher than the rate for Asians and more than twice as high as the rate for Hispanics. The differences between the rate for blacks and all other categories are statistically significant, as is the difference between whites and Hispanics and Asians (Table B1.8). Although the most common mechanism of homicide is firearms for all categories, the proportions are highest for Hispanics and blacks (Table B1.11).

Table B1.11. Homicide by Mechanism and Race/Ethnicity
California Residents Age 55 and Over, 1995

	White	Black	Hispanic	Asian
All Assault	**100% (116)**	**101% (41)**	**99% (42)**	**100% (20)**
Firearm	38%	49%	52%	35%
Cutting and Piercing	18%	20%	21%	15%
Hanging	15%	12%	2%	5%
Other Specific	20%	15%	12%	25%
Unknown	9%	5%	12%	20%

Source: California Department of Health Services, death records.

One of the strongest findings in homicide research is the elevated risk for poor people. Also, whites generally have both higher socioeconomic status (SES) and lower homicide rates than most nonwhite groups. This pattern suggests that class and race are somehow intertwined. Table B1.12 contrasts homicide rates for whites versus other races/ethnicities, by education level. (The number of homicides is too small to allow us to look at black, Hispanic, and Asians separately.)

Table B1.12 shows homicide rates by race and educational attainment, our proxy for SES. As expected, the homicide rate for older Californians with more than 12 years of education (2.3) is markedly lower than rates for high school graduates (4.4) and those with less than 12 years of education (5.1). The SES effect holds for both whites and nonwhites, with a clear advantage going to elders with more than 12 years of school. Thus, both SES and race/ethnicity affect the risk of homicide. Nonwhites with less than a high school education face a risk of being murdered about three to four times greater than whites with more than 12 years of education.

Table B1.12. Homicide Rate (per 100,000) By Educational Attainment and Race/Ethnicity
California Residents Age 55 and Over, 1995

	Total		< 12 Years		12 Years		> 12 Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Total	**3.8**	**3.3 – 4.3**	**5.1**	**3.9 – 6.4**	**4.4**	**3.4 – 5.4**	**2.3**	**1.7 – 2.9**
White	2.8	2.3 - 3.4	3.8	2.1 - 5.4	3.6	2.5 - 4.6	1.8	1.3 - 2.4
Nonwhite	6.2	5.0 - 7.3	6.2	4.4 - 7.9	7.1	4.3 - 9.8	4.2	2.5 - 5.9

Note: Educational attainment is used as a proxy for socioeconomic status.

Source: Numerators from California Department of Health Services, death records, and denominators from UCLA Center for Health Policy Research estimates, June 1998.

Perpetrator of Homicide

We saw earlier that older men are about three times more likely to be homicide victims compared to older women. Here we look closer at the sex discrepancy, using DHS's Linked Homicide Data File for 1990-1995. The patterns are clearly different for men and women. Data in Table B1.13 show that an intimate partner or other family member primarily kills women. In contrast, strangers, friends, or acquaintances kill men most frequently.

The precipitating event, or the circumstance, in which the homicide was committed, is also displayed on Table B1.13. Again, a different pattern emerges between the sexes. Men were killed most often while a felony was being committed or by gang activity, with the likelihood of this happening increasing as they got older. Women, on the other hand, were more often killed during fights, lover's triangles, domestic violence, and non-felony events. However, as women age, felony- and gang-related homicides rise in importance, while non-felony events fall, until a majority of the homicides for the 85 years and above age group involve a felony or gang. At all ages and for both sexes, there are a substantial number of both felony/gang homicides and non-felony homicides. Justifiable homicides are negligible.

Table B1.13. Homicide Victim-Offender Relationship and Precipitating Event by Sex and Age,
California Residents Age 55 and Over, Percentage Distributions, 1990-1995

	Males					Females				
	Total	55-64	65-74	75-84	85+	Total	55-64	65-74	75-84	85+
All, 1990-1995	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
[Number]	**[952]**	**[539]**	**[254]**	**[121]**	**[38]**	**[459]**	**[155]**	**[136]**	**[122]**	**[46]**
Offender										
Intimate Partner/Family Member	14	13	14	16	18	45	46	46	48	38
Friend, Acquaintance, Non-stranger	28	27	30	29	24	17	17	19	17	13
Stranger	30	33	28	25	29	17	15	18	16	22
Undetermined	28	27	28	31	29	20	22	17	19	27
Precipitating Event										
Felony/Gang	44	41	45	50	55	37	31	35	39	53
Non-felony	40	41	41	36	37	56	58	57	56	40
Justifiable	3	3	4	3	0	0	0	0	0	0
Undetermined	14	16	11	11	8	8	10	7	6	7

Note: Percentages may not actually add up to 100 because of independent rounding.

Source: California Department of Health Services, Linked Homicide Data File, 1990-1995.

The location of the homicide is shown in Table B1.14. Again, differences between men and women are pronounced. Most women are killed in their residences or homes they share with

the offender, but most men are killed in some other location. This finding is strongest when the offender is a friend, acquaintance, or stranger. When the offender is an intimate partner or family member, differences in location between men and women are much smaller, but women still tend to be killed in their individual or shared residences (Table B1.14).

Table B1.14. Location of Homicide by Victim-Offender Relationship,
California Residents Age 55 and Over, Percentage Distributions, 1990-1995

	Males				Females			
	Total	Intimate Partner, Family Member	Friend, Acquain-tence	Stranger, Undeter-mined	Total	Intimate Partner, Family Member	Friend, Acquain-tance	Stranger, Undeter-mined
All, 1990-1995	**101%**	**100%**	**101%**	**100%**	**100%**	**100%**	**100%**	**100%**
[Number]	**[952]**	**[134]**	**[262]**	**[556]**	**[459]**	**[210]**	**[80]**	**[169]**
Victim's Residence	39	23	52	36	50	25	71	72
Shared Residence	11	62	7	0	33	67	11	0
Other Location	51	15	42	64	17	8	18	28

Source: California Department of Health Services, Linked Homicide Data File, 1990-1995.

Homicide County Patterns

In 1995, one or more seniors were killed in a majority (59%) of counties, as Table B1.5 shows. Only Los Angeles County had a large number of victims, and a rate (5.9) that is 1.5 times the statewide rate (3.8). The 24 counties with no homicides are mostly smaller counties in the north and east.

Table B1.15. Homicide by County of Residence,
California Residents Age 55 and Over, 1995

Statewide	**219**		
Alameda	10	Orange	9
Alpine		Placer	
Amador		Plumas	
Butte	1	Riverside	5
Calaveras		Sacramento	8
Colusa		San Benito	1
Contra Costa	2	San Bernardino	10
Del Norte		San Diego	16
El Dorado	1	San Francisco	9
Fresno	4	San Joaquin	8
Glenn		San Luis Obispo	1
Humboldt	1	San Mateo	6
Imperial		Santa Barbara	
Inyo		Santa Clara	4
Kern	7	Santa Cruz	1
Kings		Shasta	2
Lake	1	Sierra	
Lassen		Siskiyou	
Los Angeles	92	Solano	1
Madera	1	Sonoma	3
Marin	1	Stanislaus	3
Mariposa		Sutter	1
Mendocino		Tehama	
Merced	1	Trinity	
Modoc		Tulare	1
Mono		Tuolumne	
Monterey	2	Ventura	3
Napa	1	Yolo	2
Nevada		Yuba	

Source: California Department of Health Services, death records.

Discussion

Seniors have special characteristics that make them vulnerable to violence. The rates for both homicide and nonfatal assault have been falling in California and the nation.[2,7] In California, homicide rates have also been dropping for persons of all ages. Nevertheless, our numbers demonstrate that nonfatal assault and homicide remain serious problems for seniors in California. (The U.S. States Department of Health and Human Services has not set year 2000 objectives for elder homicide and nonfatal assault injuries.) Assault victims (variously defined as 60 or 65 and over) tend to have major trauma that is as severe as for younger persons, but the consequences are more extreme: significantly more morbidity, days of hospitalization, and mortality.[10,14]

Our findings indicate that blacks and males are most at risk of being injured in a fight or killed by firearms. Overall, homicide rates fall as SES rises, but nonwhites have higher homicide rates at each SES level. Dependency[8], functional disability, minority status, advancing age, and poor social networks put elders at risk[9] and are not easily addressed as narrow "public health problems." To address these factors, we must consider the status of elders overall.

Some suggestions have been made to prevent such injuries. Elders can be educated to practice safe behavior, such as using home security measures. Information, referral, and counseling services are often available to seniors. Although these approaches can be complex and costly, they are considered necessary.[15] Of course, assaults and homicides involving seniors can be prevented if the potential perpetrator can be identified and aggressive behavior defused.[15]

Approaches such as these may decrease the extent to which seniors isolate themselves in their homes because they know they are vulnerable and are afraid. Our data show that 60 percent of elder homicides occur at home (49% for males and 83% for females, indicating that different prevention strategies may be appropriate for the sexes). By refusing to leave their homes during certain times of the day that they feel are risky, elders reduce their vulnerability to assault from strangers[12] but not from those they know and trust.[8]

References

1. Elder Abuse: The Hidden Problem: Briefing by the Select Committee on Aging, U.S. House of Representatives, committee publication 96-220, U.S. Congress, 1980.
2. Leenaars AA, Lester D. Suicide and homicide rates in Canada and the United States. *Suicide Life Threat Behav*. 1994;24:184-191.
3. Langlois JA, Smith GS, Baker SP, Langley JD. International comparisons of injury mortality in the elderly: issues and differences between New Zealand and the United States. International J Epidemiol. 1995;24:136-143.
4. Lachs ML, Fulmer T. Recognizing elder abuse and neglect. *Geriatr Emerg Care*. 1993;9:665-681.
5. Council on Scientific Affairs. Elder abuse and neglect. JAMA. 1987;257:966-971.
6. U.S. Congress, House Select Committee on Aging, Elder Abuse: What Can Be Done? Washington, DC: United States Government Printing Office, 1991.
7. California Office of the Attorney General. Report on Violent Crimes Committed Against Senior Citizens in California, 1998. Criminal Justice Statistics Center Report Series, January 2000.
8. Fox JA, Levin J. Homicide against the elderly: a research note. *Criminology*. 1991;29:317-327.
9. Wolf ME, Rivara FP. Nonfall injuries in older adults. *Annual Rev Public Health*.1992;13:509-528.
10. Lachs MS, Berkman L, Fulmer T, Horwitz RI. A prospective community-based pilot study of risk factors for the investigation of elder mistreatment. *J Am Geriatr Soc*. 1994;42:169-173.
11. Schiller WR, Knox R, Chleborad. A five-year experience with severe injuries in elderly patients. *Accid. Anal. And Prev*. 1995;27:167-174.
12. Watson WH. Ethnicity, crime & aging: Risk factors and adaptation. *Generations*. 1991;15:53-57.
13. Bernard MA. The health status of African American elderly. *JAMA*. 1993;85:521-528.
14. Champion RC, Copes WS, Buyer D, Flanagan ME, Bain L, Sacco WJ. Major trauma in geriatric patients. *Am J Public Health*. 1989;79:1278-1282.
15. Allen NH. Murder among Anglo females. In: Suicidology : Essays in honor of Edwin S. Shneidman. Leenaars AA, Berman AL, Cantor P, Litman RE, Maris RW, Eds. Jason Aronson, Inc., Northvale, NJ, US. 1993, pp. 93-104.

Special Topic: Falls

Falls are *the* injury endemic of old age. As people age, they become frail and more apt to fall because they lose strength, mobility, balance, and endurance.[1] About one-third of people over age 65 report falling each year.[2-3] Although most falls do not cause serious injury among elders, falls are an overwhelming source of fatal and especially nonfatal injury.[3-6]

Nationwide, among all age groups, deaths from falls for 1996 totaled 14,100. Nearly six in 10 (58%) of these mishaps happened at home. Falls were the second largest cause of unintentional death, following motor vehicle crashes. The death rate from falls was 5.3/100,000. About four of five of these nationwide falls were among people 55 years and over.[7] In California, 764 people 55 years and older died because of falls in 1995. Falls were the largest cause of unintentional injury deaths and the second largest cause of all injury deaths, after suicide. In addition to the deaths, another 59,481 Californians 55 years and older were hospitalized because of falls in 1995. Falls were the leading hospitalized, nonfatal injury, dwarfing the second leading cause (car crash injuries) by 60-fold. (See Overview Tables A1 and A2 for California data.) Most of these injuries are preventable.

People who are at highest risk of falling are the very old; females; whites; those with impaired vision, hearing, and cognition; those who use sedatives and other medications; and those who have fallen before. Of particular importance are advancing age (the fall death rate doubles from the 55-64 to 65-74 age groups and then jumps 7-fold for the over 65 age group) and sex (males had a higher death rate from falls at any age), according to 1996 National Safety Council mortality data.[7] Also, specific chronic diseases (arthritis, lung disease, Parkinson's disease, and stroke), and other physical problems (foot problems, impairments in muscle strength, balance, and gait, and dizziness) put elders at risk.[2,8-9] The risk of falling increases as the number of chronic disabilities increases.[10-15] Environmental hazards (such as throw rugs, slippery floors, poor lighting, stairs, rugs, bathtubs, and footwear) also play a role.[6]

Consequences of falls among elders can be extreme, and personal and public economic costs are immense.[6-16] Falls also produce fear of falling and put people at risk of additional falls.[1,5,16] Elderly women are more likely to sustain fractures than men, partly due to their higher prevalence of osteoporosis.[2,3] Of all fractures resulting from falls, hip fractures produce the greatest morbidity and mortality.[17-19] Falls also diminish functioning and even independence by causing people to restrict physical and social activities out of fear of falling. In short, falls can jeopardize one's independence. Falls among seniors result in painful and long recovery periods.[1] Seniors who fall, particularly those falling more than once in the previous year, are at greater risk of subsequent hospitalization, nursing home admission, and frequent physician contact than seniors who do not fall.[4,15] In one study, about 42 percent of elders who fell were hospitalized for 11.6 days, on average.[6] In another study, about 50 percent of elders hospitalized after a fall were discharged to a nursing home.[2]

Falls Injury Data[†]

Among California residents 55 years of age or older in 1995, there were 764 fatal injuries from falls, over two each day (Table B2.1). There were also 59,481 fall-related injuries serious enough to require hospitalization, an alarming 163 each day. As Table B2.2 shows, the falls causing the most deaths are those involving stairs or steps, a chair, and slipping, tripping or stumbling on the same level. Falls on the same level produced the largest number of nonfatal, hospitalized falls.

Table B2.1. Fatal and Nonfatal Fall Injuries by Sex, Age, and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Fatal				Nonfatal			
	Number	Percent	Rate per 100,000	95% C.I.	Number	Percent	Rate per 100,000	95% C.I.
All	**764**	**100**	**13.3**	**12.4 – 14.2**	**59,481**	**100**	**1,035.4**	**1027.1 – 1043.7**
Sex								
» Male	397	52	15.6	14.0 - 17.1	17,103	29	670.3	660.3 - 680.3
» Female	367	48	11.5	10.3 - 12.7	42,377	71	1,361.5	1348.8 - 1374.2
Age Group								
» 55-64 Years	76	10	3.3	2.5 - 4.0	6,169	10	266.4	259.8 - 273.1
» 65-74 Years	148	19	7.6	6.4 - 8.8	12,807	22	655.5	644.2 - 666.8
» 75-84 Years	243	32	21.7	18.9 - 24.4	22,096	37	1,969.1	1943.4 - 1994.8
» 85 Years +	297	39	84.0	74.4 - 93.5	18,409	31	5,203.5	5130.3 - 5276.7
Race/Ethnicity								
» White	629	82	15.4	14.2 - 16.7	49,364	83	1,212.3	1201.6 - 1222.9
» Black	20	3	6.3	3.6 - 9.1	1,863	3	589.8	563.1 - 616.5
» Hispanic	69	9	8.4	6.4 - 10.4	4,986	8	605.8	589.0 - 622.6
» Asian/Pacific Islander	43	5	8.5	6.0 - 11.1	2,193	4	435.6	417.4 - 453.8
» Other	3	*	**	**	604	1	1,980.3	1824.0 - 2136.7

Note: Percentages may not actually add up to 100 because of independent rounding.

* Less than .05 percent.

** Rates were not computed for fewer than 20 cases.

*** For nonfatal falls, one case of gender unknown and 471 cases of race/ethnicity unknown are excluded here.

Source: California Department of Health Services, death records, and California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

[†] We analyze fall-related injury patterns and trends by identifying computerized hospital discharge records and death certificates where the external cause of injury or the underlying cause of death is coded "accidental falls." We include ICD-9 code series E880.0-E886.9 and E888. (Some researchers include E887, a fracture from an unspecified cause, as a fall. We do not.) For nonfatal hospitalized cases, we eliminate duplication with fatal cases by removing persons who died in the hospital.

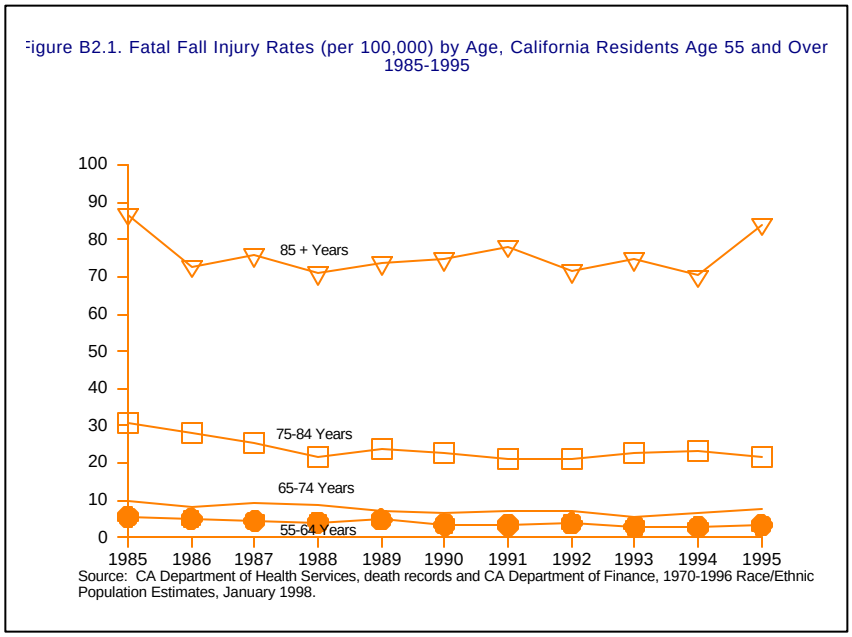
Table B2.2. Fatal and Nonfatal Fall Injuries by Type of Fall,
California Residents Age 55 and Over, 1995

	Fatal		Nonfatal	
	Number	Percent	Number	Percent
All	**764**	**99**	**59,481**	**100**
On/from stairs/steps (E880)	40	5	2,030	3
On/from ladder/scaffolding (E881)	33	4	1,098	2
From/out of building/other structure (E882)	22	3	249	*
Into hole/other opening in surface (E883)	0	0	45	*
From one level to another (E884):				
» Playground equipment (E884.0)	0	0	7	*
» Cliff (E884.1)	4	1	17	*
» Chair (E884.2)	38	5	3,399	6
» Wheelchair (E884.3)	0	0	143	*
» Bed (E844.4)	0	0	502	1
» Other Furniture (E844.5)	0	0	52	*
» Commode (E844.6)	0	0	96	*
» Other (E844.9)	11	1	1,589	3
Same level from slipping/tripping/stumbling (E885)	41	5	25,432	43
Same level contact with another person (E886):				
» Tackles in sports (E886.0)	0	0	27	1
» Other and unspecified (E886.9)	0	0	227	*
Other and unspecified fall (E888)	575	75	24,568	41

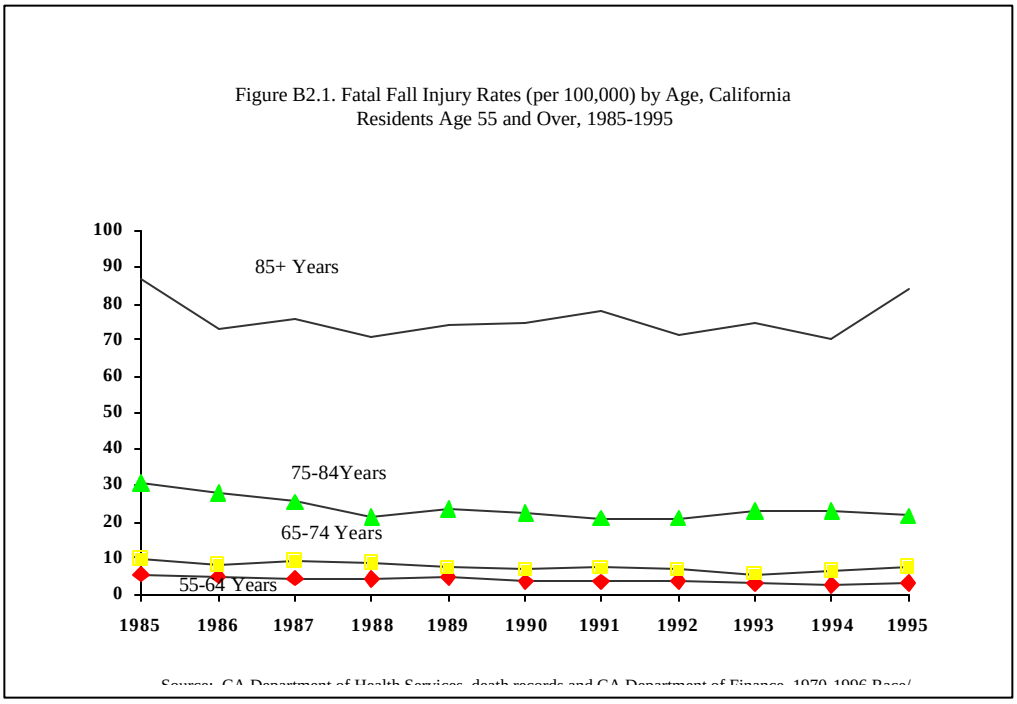
Source: California Department of Health Services, death records, and California Office of Statewide Health Planning and Development, hospital records.

Trends

Fatal Injuries. Fatal fall injury rates (per 100,000) for the 11-year period, 1985-1995 are displayed on Figure B2.1. For all elders, rates fell fairly consistently from 15.7 in 1985 to 12.0 in 1990, stayed at this level through 1994 and ended a little higher at 13.3 in 1995. Across the entire period, the average annual rate fell slightly (-1.4%). All age groups experienced average annual rate declines in fatal fall injuries during the 11-year period. The declines from high to low are -4.1 percent for the 55-64 age group, -3.1 for the 75-84 age group, -1.6 percent for the 65-74 age group, and -0.1 percent for the 85 years and older age group.



Nonfatal Injuries. Figure B2.2 shows hospitalized, nonfatal fall injury rates (per 100,000) for the 5-year period, 1991-1995. Rates rose slightly from 971 in 1991 to 1,014 in 1995, the average annual rate increase being 1.6 percent. Only the 55-64 year age group experienced a decline (-1.3%), as the average rate change for the other groups rose (by 0.4% for those age 65-74, 0.4% for those age 75-84, and 1.7% for those age 85 and over).



Sex, Age, and Race/Ethnicity Patterns

Fatal Injuries. Table B2.1 shows demographic risk patterns for elder fall-related fatal injuries. Although a small majority of victims are men, the male rate is 1.3 times higher than females, a statistically significant difference. Age is the strongest risk factor. Fatality rates increase significantly with each age group. The rate for the oldest group is more than 25-fold higher than the rate for the near old 55-64 age group. Whites, with more than four in five fatalities, have the highest rate. The rates for whites are about twice as high as the rates for the other race/ethnicity groups, a statistically significant difference.

Do these fatal injury rate patterns for the race/ethnicity categories persist when the data are adjusted by socioeconomic status (SES)? Yes. (Table B2.3). Whites have significantly higher fatal injury rates than nonwhites (we combined blacks, Hispanics, and Asians so numbers would be large enough to compute rates) at every educational attainment level. But the difference between the white-nonwhite rates was greatest at the less than 12 years of education group, compared to the high school graduate (1.6 times) or more than 12 years of educational (2.3 times) attainment groups. For whites, fatality rates fell significantly as educational attainment rose. But nonwhites have a different pattern. Fatalities rose between less than high school and high school graduate groups (but not significantly so), and then fell significantly for the higher than 12 years of education group. We can conclude from these data that whites die from falls at a higher rate than nonwhites at every SES level, and that both white and black victims at the highest SES level have the lowest fatality rates.

Table B2.3. Fatal Fall Injury Rate (per 100,000 by Educational Attainment and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Total		< 12 Years		12 Years		> 12 Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Total	**13.3**	**12.3-14.2**	**16.2**	**14.0-18.4**	**17.6**	**15.6-19.6**	**8.5**	**7.4-9.6**
White	15.4	14.2-16.7	26.7	22.4-30.9	19.6	17.2-22.1	9.5	8.2-10.7
Nonwhite	7.7	6.4-9.0	8.2	6.2-10.3	12.2	8.7-15.8	4.0	2.3-5.7

Note: Educational attainment is used as a proxy for socioeconomic status.

Source: Numerators from California Department of Health Services, death records, and denominators from UCLA Center for Health Policy Research estimates, June 1998.

Nonfatal Injuries. In contrast to fatalities, most elders hospitalized for falls are women (Table B2.1). The nonfatal fall rate for women is twice that for males, a statistically significant difference. As with fatalities, nonfatal injury rates increase significantly with advancing age. The rate for the oldest group is nearly 20-fold higher than that of the youngest 55-64 age group. Also as with fatalities, four in five nonfatal fall victims are white. Asians have the lowest rate, and persons of other race/ethnicity (Aleuts, Eskimos, and Native Americans) have the highest rates. With the exception of the black and Hispanic rates, all other rates are significantly different from each other.

Injury or Condition Causing Hospitalization

Principal diagnosis, the condition established by the admitting doctor as being the chief cause for hospital admission, is vital for our special topic of falls. We have summarized injury and noninjury principal diagnoses by elder age group (Table B2.4). In other words, if the senior fall victim was admitted to the hospital because of a fracture, this would be found in the top portion of the table, labeled "Injuries;" if the fall victim was admitted because of a circulatory disorder, this would be found in the "Noninjury Conditions" portion. "Injuries" can be thought of as

consequences of falling and noninjuries, risk factors for falling. Of all 59,481 fall victims, 41,599 or 70 percent were admitted because of an injury. This percentage did not increase with advancing age as we expected, with the 65-74 years age group having the lowest percentage (68%) and the 75-84 years age group having the highest (77%).

Looking at the injuries, we see that fractures are the overwhelming consequence of falling. The proportion of all fractures combined to all injuries rose steadily from 90 percent for the 55-64 years age group to 93 percent for the 85 years and over age group. Hip fractures alone amounted to 67 percent of all fractures, and 61 percent of all injuries, and 38 percent of all falls. The rate (per 100,000) jumped 51-fold between the 55-64 years age group and the 85 years and older age group, the largest increase of any injury. The upper body is especially vulnerable to injury as people age. Face, neck, and trunk fracture rates rose 30-fold from 55-64 to 85 years and over. Also rates of traumatic brain injury increased 11-fold between the youngest and oldest age groups.

Looking at the noninjury conditions, the top three were associated with 55 percent of the falls: circulatory disorders, chronic disorders and respiratory disorders. For all noninjury conditions, rates invariably rose with increasing age. The conditions with the largest increase in rates between the youngest and oldest age groups are circulatory disorders (29-fold), followed by respiratory disorders and musculoskeletal and connective tissue disorders (24-fold each).

Table B2.4. Principal Diagnosis Rates (per 100,000) for Nonfatal Hospitalized Fall Injuries by Age, California Residents Age 55 and Over, 1995

	Total		55-64		65-74		75-84		85+	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total	**59,481**	**1,035**	**6,169**	**266**	**12,807**	**656**	**22,096**	**1,969**	**18,409**	**5,204**
Injuries										
» Hip Fracture	22,850	398	1,122	48	3,905	200	9,162	816	8,661	2,448
» Lower Limb Fracture	5,946	104	1,583	68	1,808	93	1,574	140	981	277
» Face/Neck/Trunk Fracture	5,252	91	424	18	968	50	1,959	175	1,901	537
» Upper Limb Fracture	3,926	68	608	26	1,105	57	1,357	121	856	242
» Traumatic Brain Injury	2,363	41	348	15	597	31	841	75	577	163
» Spinal Cord Injury	124	2	26	1	39	2	38	3	21	6
» Other Injury	1,138	20	189	8	247	13	383	34	319	90
Noninjury Conditions										
» Circulatory System Disorders	4,208	73	301	13	902	46	1,685	150	1,320	373
» Chronic Disorders*	3,978	69	413	18	971	50	1,555	139	1,039	294
» Respiratory System Disorders	1,580	28	141	6	328	17	613	55	498	141
» Endocrine, Nutritional, & Metabolic Disorders	1,126	20	114	5	275	14	401	36	336	95
» Musculoskeletal/ Connective Tissue Disorders	1,047	18	92	4	217	11	396	35	342	97
All Other**	5,943	103	808	35	1,445	74	2,132	190	1,558	440

* Such as skin disorders, neoplasms, and congenital anomalies.

** Such as observations, visits, and complications.

Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Populations Estimates, January 1998.

Place of Injury

We begin with a methodological note. For nonfatal fall injuries, we excluded cases with multiple falls so we could more precisely determine the place of injury for the fall resulting in hospitalization. A total of 57,886 (97%) of all 59,481 nonfatal fall victims were hospitalized for one fall. Of these, place of injury was missing for 3,785 records, leaving 54,101 records (93%) for analysis in Table B2.5.

Table B2.5. Place of Injury for Nonfatal Fall by Age,
California Residents Age 55 and Over, 1995, Percentage Distribution

	Total		55-64	65-74	75-84	85+
	Number	Percent	100%	99%	100%	100%
All [Number]	54,101**	99%	[5,315]	[11,507]	[20,199]	[17,080]
Home	36,154	67	54	65	70	68
Residential Institution	8,249	15	8	11	15	21
Public Building	1,834	3	6	4	3	2
Street or Highway	1,258	2	4	3	2	2
Sports/Recreation Place	560	1	4	2	1	*
Industrial Place***	553	1	5	1	*	*
Place Unspecified	5,493	10	19	13	9	7

* Less than .05 percent.

** Total does not include 3,785 cases with place unknown.

*** Included here are "farm" (45 falls) and "mine or quarry" (7 falls).

Source: California Office of Statewide Health Planning and Development, hospital records.

Two-thirds of the falls occurred at home. Broadening the definition of "home" to include "residential institutions," we see that more than four in five falls occur at home. Also, the percentage of falls at home increases with age (Table B2.5). Falls in public buildings and on streets or highways are also common.

County Patterns

Fatal Injuries. Table B2.6 shows fatal injury rates by victims' county of residence. Rates are given for counties with 20 or more fatalities. Ventura County has the highest rate, nearly twice that of the statewide rate. San Francisco County has the second highest rate. The risk of fatal falls is lowest in San Diego and Los Angeles Counties.

Table B2.6. Fatal Fall Injury Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**764**	**13.3**			
Alameda	34	14.1	Orange	62	14.0
Alpine	0	*	Placer	7	*
Amador	2	*	Plumas	1	*
Butte	11	*	Riverside	44	15.6
Calaveras	0	*	Sacramento	34	16.5
Colusa	1	*	San Benito	0	*
Contra Costa	27	15.7	San Bernardino	27	11.5
Del Norte	0	*	San Diego	46	9.8
El Dorado	2	*	San Francisco	33	18.7
Fresno	19	*	San Joaquin	15	*
Glenn	1	*	San Luis Obispo	14	*
Humboldt	4	*	San Mateo	13	*
Imperial	1	*	Santa Barbara	11	*
Inyo	1	*	Santa Clara	37	13.6
Kern	14	*	Santa Cruz	6	*
Kings	2	*	Shasta	7	*
Lake	4	*	Sierra	0	*
Lassen	0	*	Siskiyou	2	*
Los Angeles	166	10.7	Solano	11	*
Madera	5	*	Sonoma	6	*
Marin	6	*	Stanislaus	19	*
Mariposa	1	*	Sutter	1	*
Mendocino	6	*	Tehama	1	*
Merced	5	*	Trinity	1	*
Modoc	1	*	Tulare	1	*
Mono	0	*	Tuolumne	1	*
Monterey	5	*	Ventura	31	24.7
Napa	8	*	Yolo	3	*
Nevada	4	*	Yuba	0	*

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Table B2.7. Nonfatal Fall Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**59,481**	**1,035**			
Alameda	2,448	1,017	Orange	4,963	1,122
Alpine	0	*	Placer	518	1,232
Amador	127	1,277	Plumas	57	925
Butte	557	1,074	Riverside	2,746	972
Calaveras	116	1,031	Sacramento	2,192	1,066
Colusa	34	923	San Benito	63	821
Contra Costa	1,663	969	San Bernardino	2,180	928
Del Norte	48	795	San Diego	5,038	1,077
El Dorado	265	866	San Francisco	1,855	1,052
Fresno	1,142	900	San Joaquin	983	1,029
Glenn	57	1,001	San Luis Obispo	532	1,047
Humboldt	301	1,209	San Mateo	1,442	976
Imperial	189	832	Santa Barbara	835	1,080
Inyo	44	798	Santa Clara	2,183	803
Kern	1,093	1,053	Santa Cruz	462	1,082
Kings	139	881	Shasta	416	1,107
Lake	213	1,186	Sierra	9	*
Lassen	39	717	Siskiyou	110	920
Los Angeles	16,456	1,058	Solano	437	771
Madera	146	694	Sonoma	1,125	1,302
Marin	551	1,058	Stanislaus	943	1,288
Mariposa	40	826	Sutter	222	1,407
Mendocino	219	1,183	Tehama	127	864
Merced	259	828	Trinity	47	1,329
Modoc	18	*	Tulare	639	1,054
Mono	4	*	Tuolumne	183	1,274
Monterey	647	1,073	Ventura	1,234	981
Napa	408	1,402	Yolo	269	1,083
Nevada	303	1,215	Yuba	145	1,317

* Rates were not computed for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Nonfatal Injuries. Table B2.7 displays county of residence rates for fall-related injuries requiring hospital stays. Serious falls are so prevalent that there are only four (of California's 58) counties with fewer than 20 falls for 1995. The top three counties with the highest rates are Sutter, Napa, and Trinity. Madera, Lassen, and Solano Counties have the lowest rates.

Discussion

Falls kill or badly injure many older Californians. In 1995, falls were the leading nonfatal injury and the second leading fatal injury, killing two and seriously injuring 163 older California residents each day. Fatalities decreased slightly during the 11-year period 1985-1995, but nonfatal injuries increased slightly during the five-year period 1991-1995. The Centers for Disease Control and Prevention has year 2000 objectives for fall-related fatal injuries for two elder population groups: 14.4 per 100,000 for persons 65-84 years and 105 per 100,000 for

persons 85 years and older. With 1995 rates of 12.7 for the 65-84 age group and 84.0 for the 85 and older age group, California is already below the federal objectives.

Who is most at risk of being injured by falls? Disproportionately injured are whites, people 85 years and older for both fatal and nonfatal injuries, men for fatal falls, and women for nonfatal falls. For fatalities, whites die from falls at a higher rate than nonwhites at every SES level, and the highest SES level tends to have the lowest fatality rates for both whites and blacks.

Falls most often take place at the victim's residence, a personal home or residential institution. Counties with the highest rates are Ventura and San Francisco for fatal falls and Sutter and Napa for nonfatal falls. Trips, slips, or stumbles on the same level occur more often than other kinds of falls.

Falls cause huge personal and public economic costs. Strategies for both surveillance and prevention are critical.[6] Interventions have taken many approaches, including risk assessment via patient interviews, mobility testing, clinical examination, education, exercise to improve gait, balance, strength or endurance (including Tai Chi), prevention of fragile bones by calcium and vitamin D supplementation, home environment safety inspections, and medication monitoring.[8,10-13,20-27] According to the Department of Health Services program staff, the following mix of interventions is particularly promising for California seniors: education; exercise to improve strength, endurance and balance; and assessment and treatment of risk factors.

References

1. Weindruch R, Hadley EC, Ory MG (editors). *Reducing Frailty and Falls in Older Persons*. Sprinfield, Ill.: Charles C. Thomas, 1991.
2. Sattin RW, Huber DAL, DeVito CA, Rodriguez JG, Ros A, Bacchelli S, Stevens JA, Waxweiler RJ. The incidence of fall injury events among the elderly in a defined population. *Am J Epidemiol*. 1990;131:1028-1037.
3. Lilley JM, Arie T,Chilvers CE. Accidents involving older people: a review of the literature. *Age and Ageing.* 1995;24:346-365.
4. Kiel DP, O'Sullivan P, Teno JM, Mor V. Health care utilization and functional status in the aged following a fall. *Med Care*. 1991;29:221-228.
5. City and County of San Francisco, Department of Public Health. Injuries to San Francisco seniors: defining the problem and prioritizing prevention strategies. December 9, 1996.
6. Sattin RW. Falls among older persons: a public health perspective. *Annu. Rev. Publ. Health.* 1992:13:489-508.
7. National Safety Council. *Accident Facts, 1997 Edition*. Itasca, Illinois.
8. King MB, Tinetti ME. Falls in community-dwelling older persons. *J Am Geriatr Soc*. 1995;43:1146-1154.
9. Lipsitz LA, Jonsson PV, Kelley MM, Koestner JS. Causes and correlates of recurrent falls in ambulatory frail elderly. *J Gerontol*. 1991;46:M114-122.
10. Tinetti ME, Williams TF, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. *Am J Med.* 1986;80:429-434.
11. Robbins AS, Rubenstein LZ, Josephson KR, Schulman RL, Osterweil D, Fine G. Predictors of falls among elderly people; results of two population-based studies. *Arch Intern Med*. 1989;149:1628-1633.
12. Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls. *JAMA*. 1989;261:2663-2668.
13. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Eng J Med.* 1988;319:1701-1707.
14. Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, Koch ML, Trainor K, Horwitz RI. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med*. 1994;331:821-827.
15. Alexander BH, Rivara FP, Wolf ME. The cost and frequency of hospitalization for fall-related injuries in older adults. *Am J Public Health*. 1992;82:1020-1023.
16. Mayo NE, Korner-Bitensky N, Levy AR. Risk factors for fractures due to falls. *Arch Phys Med Rehabil*. 1993;74:917-921.
17. Cumming RG, Klineberg RJ. Fall frequency and characteristics and the risk of hip fractures. *J Am Geriatr Soc*. 1994;42:774-778.
18. Rubin CD. Southwestern internal medicine conference: prevention of hip fractures in the elderly. *Am J Med Sci*. 1995;310:77-85.
19. Hayes WC, Myers ER, Morris JN, Gerhart TN, Yett HS, Lipsitz LA. Impact near the hip dominates fracture risk in elderly nursing home residents who fall. *Calcif Tissue Int.* 1993;52:192-198.

20. Schulman RL, Osterweil D, Fine G. Predictors of falls among elderly people; results of two population-based studies. *Arch Intern Med*. 1989;149:1628-1633.

21. Wolf SL, Barnhart HX, Kutner NJ, McNeely E, Coogler C, Xu T. Reducing frailty and falls in older persons: an investigation of tai chi and compterized balance training. *J Am Geriatr Soc*. 1996;44:489-497.

22. Fiatarone MA, O'Neill EF, Ryan ND, Clements KM, Solares GR, Nelson ME, Roberts SB, Kehayias JJ, Lipsitz LA, Evans WJ. Exericse training and nutritional supplementation for physical fraility in very elderly people. *N Engl J Med*. 1994;330:1769-1775.

23. Meunier PJ. Prevention of hip fractures. *Amer J Med*. 1993;95:75S-78S.

24. Wolinsky FD, Fitzgerald JF. The risk of hip fracture among noninstitutionalized older adults. *J Gerontology: Social Sciences*. 1994;49:S165-S175.

25. Compston JE. The role of vitamin D and calium supplementation in the prevention of osteoporotic fractures in the elderly. *Clinical Endocrinology*. 1995;43:393-405.

26. Visentin P, Ciravegna R, Uscello L, Molaschi M, Fabris F. Site-specific relative risk of fractures in the institutionalized elderly. *Gerontology*. 1995;41:273-279.

27. Topper AK, Makai BE, Holliday PJ. Are activity-based assessments of balance and gait in the elderly predictive of risks of falling and/or type of fall? *J Am Geriatr Soc*. 1993;41:479-487.

Special Topic: Motor Vehicle Occupant Injuries

As we age, our ability to drive a car safely may eventually decline. Motor vehicle (MV) crashes are a significant cause of injury for older people nationwide and in California. In fact, MV crashes are the second leading cause of both fatal injury (after suicide) and serious nonfatal injuries causing hospitalization (after falls).[1-2] (See Overview Tables A1 and A2 for 1995 California data.) Nationwide, seniors (followed by teenagers) have the highest fatal MV injury rates per mile driven. (People in their 40s have the lowest rates.)[3-4,5]

Why do elders have high MV injury rates? As we age, visual acuity, reaction time, and the ability to make quick decisions decline.[1,4,6-9] State-mandated vision tests lower the fatal crash risk among drivers 70 years or older.[10] Hearing aids appear to be associated with increased risk for MV crash injuries.[11] Older drivers with a long history of diabetes, and those with both diabetes and coronary heart disease, have an elevated risk for MV crashes.[12] Elders often have significant health problems and may take medicines which impair driving ability[7,13] although findings are mixed.[14] Older users of any psychoactive drug are at increased risk of MV crash injury,[15] although it is unclear which psychoactive drugs (such as antidepressants and opioid analgesics) produce the most risk.[16-17] Taken together, the mix of physical decline and use of medications among elders increases the risk of serious injury from MV crashes. Another possibility is that frailty alone increases the risk of serious injury among elders, compared to young people. A car crash, or any trauma, puts a frail older person at greater risk of serious injury than a younger person.[18-19]

Seniors are the fastest growing segment of the population. From 1985 to 1995, the proportion of drivers age 65 and over grew 12 percent. The percentage of drivers 80 and older grew 50 percent during this time.[5] The number of drivers over age 65 will likely soar as baby boomers age. Some call this an "ominous trend."[20] California Department of Motor Vehicles (DMV) researchers are less alarmed because older drivers spend less time on the road and drive fewer miles.[19]

In California, drivers 70 years and over must renew their licenses in person rather than by mail every five years (currently the standard license period). The DMV requires that they take a written test and have their visual acuity checked? two screening methods that can reveal loss of abilities required for safe driving. Doctors, law enforcement, family, and DMV technicians may refer drivers for review at any time. In 1997, about 30,000 such drivers (about half of those evaluated) had their licenses suspended or revoked for physical and mental conditions such as lapse of consciousness, Alzheimer's disease, and lack of knowledge or skill regarding driving. These DMV policies strive to balance the considerable benefits and risks of driving for older Californians. As California DMV Director Sally Reed says, "California law focuses on getting risky drivers of any age off the road rather than punishing whole groups."

Motor Vehicle Occupant Injury Data†

Among California residents 55 years of age or older in 1995, there were 556 fatal MV occupant injuries, nearly 11 each week (Table B3.1, located in Age, Sex, and Race/Ethnicity Patterns section below). There were also 4,369 injuries serious enough to require hospitalization or 84 each week.

Besides calculating rates based on California population data to estimate risk of MV occupant injury, we also calculated rates based on number of licenses from DMV data. This is important for studying older drivers because the number of licensed drivers decreases with advancing age. Thus, rates based on licensure data allow us to differentiate risk to all elders from risk to elders who drive. We also used 1995 Department of California Highway Patrol (CHP) data on traffic fatalities and injuries and whether seat belts and passive restraints are used. The number of fatalities reported by CHP is consistently less than those reported in the Department of Health Services' (DHS) death records. The CHP data cover all collisions on state highways and all other roadways, except private property. The death records cover all car crash fatalities wherever they take place. Another reason that the CHP reports fewer deaths is that only persons who die within 30 days of the crash are counted. The number of nonfatal injuries is greater in CHP data than in hospital discharge data because the CHP definition of "injury" includes many victims whose injuries do not require hospitalization. The CHP published data group all persons age 60 and over so we are unable to display our usual age categories.

We also use the DHS's Behavioral Risk Factor Survey (BRFS), a representative sample of California households contacted via a computerized telephone system. The self-reported data items we use are: (1) whether people use safety belts and (2) whether they drink and drive.

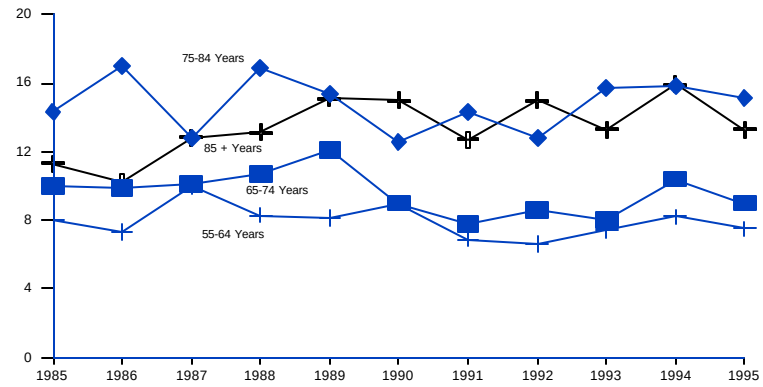
Trends

Fatal Injuries. Fatal MV occupant injury rates (per 100,000) based on California population data for the 11-year period, 1985-1995, are displayed on Figure B3.1. For all elders, rates fluctuated and showed an overall average annual rate change of +0.4 percent. During the 1985-1995 period, persons 75 years and over clearly had higher fatal injury rates than those under age 75. The oldest group, persons 85 years and over, had the largest average annual rate increase (2.7%) for 1985-1995, followed by the 75-84 age group (2.1%), with virtually no change for the 65-74 age group (0.1%). Only the 55-64 age group registered an average annual rate decline (-2.1%).

Nonfatal Injuries. Hospitalized injury rates based on population data for the five-year period 1991-1995 appear in Figure B3.2. Overall, rates dropped unevenly from 82.8 for 1991 to 76.1 for 1995, with an average annual rate decline of two percent. Declining rate trends for the various age groups are unremarkable, except that the 85 years and older age group registered a small average annual rate increase for 1985-1995 (0.8%).

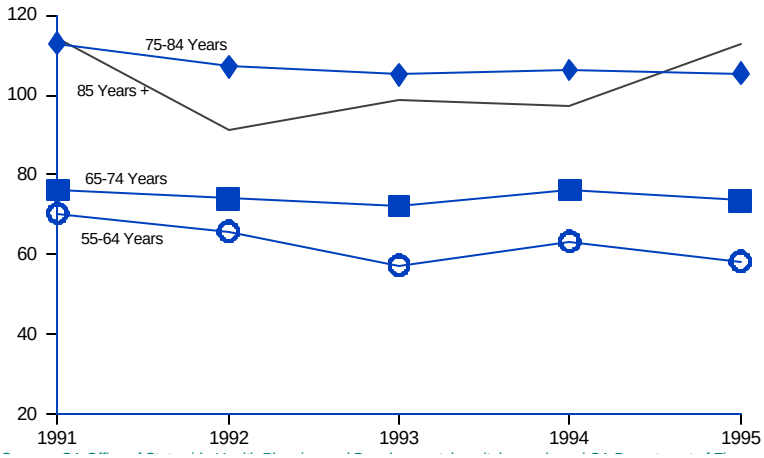
† We examine MV occupant injury patterns and trends by identifying computerized hospital discharge records and death certificates where the external cause of injury or the underlying cause of death is coded "motor vehicle traffic accidents." We looked at ICD-9 code series E810-E819, identifying the drivers (4th digit 0) and passengers (4th digit 1). For nonfatal hospitalized cases, we eliminate duplication with fatal cases by removing persons who died in the hospital.

Figure B3.1. Fatal Motor Vehicle Occupant Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1985-1995



Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Figure B3.2. Nonfatal Motor Vehicle Occupant Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1991-1995



Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Sex, Age, and Race/Ethnicity Patterns

Fatal Injuries. Table B3.1 shows demographic risk patterns for elder MV occupant fatalities. The male rate is 1.6 times that of females, a statistically significant difference. Age is a strong risk factor, with the rate doubling from 55-64 to 75-84. None of the race/ethnicity differences is statistically significant, although white and Asian rates are nominally higher.

Table B3.1. Fatal and Nonfatal Motor Vehicle Occupant Injuries by Sex, Age, and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Fatal				Nonfatal			
	Number	Percent	Rate per 100,000	95% C.I.	Number	Percent	Rate per 100,000	95% C.I.
All	**556**	**100**	**9.7**	**8.9 – 10.5**	**4,369**	**100**	**76.1**	**73.8 – 78.3**
Sex								
» Male	313	56	12.3	10.9 - 13.6	1,989	46	78.0	74.5 - 81.4
» Female	243	44	7.6	6.7 - 8.6	2,380	54	74.5	71.5 - 77.5
Age Group								
» 55-64 Years	173	31	7.5	6.4 - 8.6	1,349	31	58.3	55.2 - 61.4
» 65-74 Years	176	32	9.0	7.7 - 10.3	1,436	33	73.5	69.7 - 77.3
» 75-84 Years	160	29	15.1	12.8 - 17.3	1,184	27	105.5	99.5 - 111.5
» 85 Years +	47	8	13.3	9.5 - 17.1	400	9	113.1	102.0 - 124.1
Race/Ethnicity								
» White	407	73	10.0	9.9 - 11.0	3,164	72	77.7	75.0 - 80.4
» Black	25	5	7.9	4.8 - 11.0	229	5	72.5	63.1 - 81.9
» Hispanic	68	12	8.3	6.3 - 10.2	531	12	64.5	59.0 - 70.0
» Asian/Pacific Islander	54	10	10.7	7.9 - 13.6	296	7	58.9	52.1 - 65.5
» Other	2	*	**	**	90	3	295.1	234.2 - 356.0

Note: Percentages may not actually add up to 100 because of independent rounding.

* Less than .05 percent.

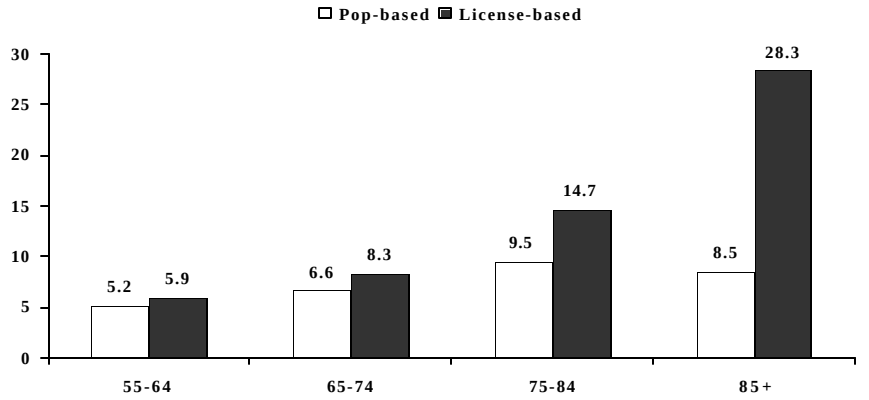
** Rates were not computed for fewer than 20 cases.

*** 59 nonfatal cases with unknown race/ethnicity excluded here.

Source: California Department of Health Services, death records, and California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

As drivers age, fatal MV injury rates climb. Rates based on population data nearly double from the 55-64 age group to the 75-84 age group and then fall slightly. But rates based on licensure data rise 2.5-fold from 55-64 years to 75-84 years and then double again from 75-85 to 85 and over. The differences between rates based on population and licensure increase with advancing age, as Figure B3.3 shows. But the license-based rate is always higher than the population-based rate. The license-based rate jumps from 1.1 times higher than the population-based rate for the 55-64 age group to 3.3 times higher for the 85 years and over age group. The reason for these differences is that the number of licensed drivers declines with increasing age, but those still driving are at high risk of fatal injury.

Figure B3.3. Fatal Motor Vehicle Driver Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1995



CA Department of Health Services, death records; CA Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998; and CA Department of Motor Vehicles, licensure data.

Since car ownership is costly, the somewhat higher rates among whites could reflect differences in socioeconomic status (SES). To shed light on this, although indirectly, we developed Table B3.2, which shows education differences in car crash fatalities for whites versus all other races. (Detailed nonwhite breakdowns were not possible because of small numbers.) Although differences are not significant, white rates appear higher than nonwhite rates both for those with less than a high school diploma (< 12 years) and those with a high school diploma (12 years). For victims with more than a high school diploma (> 12 years), the difference between whites and all others disappears entirely. For both whites and nonwhites, rates appear to be highest for high school graduates and lowest for people with more than a high school education. SES, as measured by years of education, does not imply greater risk. But we caution that education, our proxy for SES, may not be a good indicator of the ability to drive a car.

Table B3.2. Fatal Motor Vehicle Occupant Injury Rates (per 100,000) by Educational Attainment and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Total		< 12 Years		12 Years		> 12 Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Total	**9.7**	**8.9 – 10.5**	**9.8**	**8.1 – 11.4**	**12.3**	**10.4 – 14.6**	**7.5**	**6.5 – 8.6**
White	10.0	9.9-11.0	10.7	8.0-13.4	13.5	11.4-15.5	7.4	6.2-8.5
Nonwhite	8.7	7.3-10.1	9.0	6.9-11.2	9.5	6.4-12.7	7.8	5.5-10.1

Note: Educational attainment is used as a proxy for socioeconomic status.

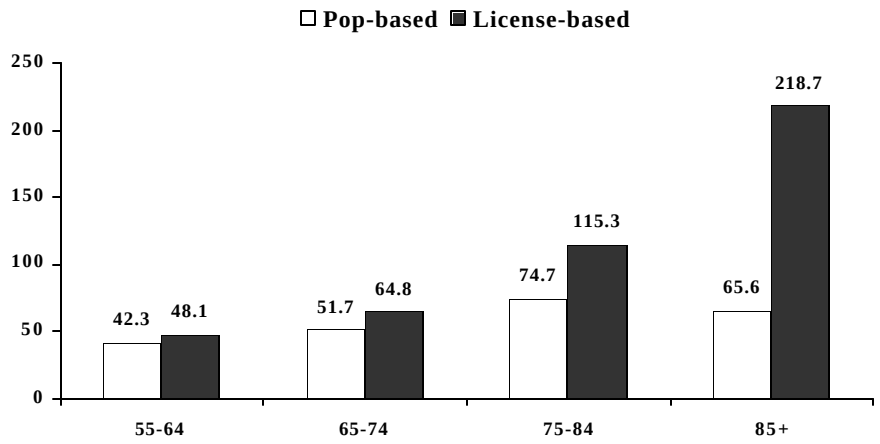
Source: Numerators from California Department of Health Services, death records, and denominators from UCLA Center for Health Policy Research estimates, June 1998.

Nonfatal Injuries. A majority of elders hospitalized for MV occupant injuries are women, but the rate for men is somewhat higher than the rate for women (the difference is not statistically significant) (Table B3.1). We attribute this seeming paradox to the fact that, with advancing age, there are more females and fewer males in the California population. The increasing numbers of women versus men apparently diminish the difference in the injury rates.

For nonfatal (unlike fatal) injuries, rates increase with advancing age. The rate for the oldest group is double that of the youngest group. The white rate is significantly higher than the Hispanic and Asian rates, but the rate for the "Other" category is significantly higher than for all other groups. "Other" consists of American Indians, Eskimos/Aleuts, and unspecified others.

Like fatalities, injury rates based on licensure data are always higher than rates based on population data, because fewer people have licenses as they get older. Also like fatalities, the differences between rates based on population and licensure data increase with advancing age (Figure B3.4). Compared to the population-based rate, the license-based rate is more than three times higher for the 85 years and over age group. The oldest licensed drivers are at highest risk for car crashes.

Figure B3.4. Nonfatal Motor Vehicle Driver Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1995



Source: CA Office of Statewide Health Planning & Development, hospital records; CA Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998; and CA Department of Motor Vehicles, licensure data.

Safety Practices: Safety Belt Use and Drinking and Driving

We turn to CHP crash data and other data sources to analyze these issues. Earlier in this section, we noted that elders generally have higher crash injury rates than younger adults. We cited studies showing that aged drivers may be frail and less able to recover from an injury. We cited other studies showing that many older drivers may have health problems that impair driving ability. Here, we consider a third possibility: safe practices. Are older drivers less likely to buckle up and more likely to drink and drive?

Although safety belt use is high for all ages in California, seniors report slightly higher use than younger adults. In a representative sample of California households, the DHS's 1995 BRFS found reported safety belt use rates of 88 percent for persons 55 years and over and 85 percent for persons 18-54 years. Based on curbside observation studies, safety belt use across all ages in California reached 90 percent by 1998, the highest in the nation.[21]

Because safety belts were not used by many older victims actually involved in car crashes, there is room for improvement. According to 1995 CHP data (Table B3.3), nearly one-half of persons age 55 and over involved in a fatal MV traffic collision did not wear a seat belt or passive restraint. For collisions resulting in mild to severe injuries, about one-fourth did not wear a seat belt or passive restraint. Nonuse of safety equipment does not vary much by age.

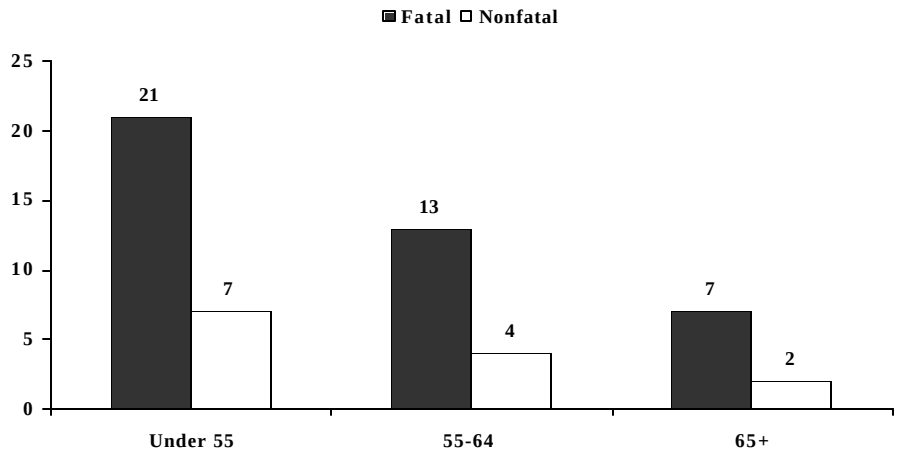
Table B3.3. Fatal and Nonfatal Motor Vehicle Traffic Vehicle Traffic Collisions by Age, Seat Belt, and Passive Restraint Use, California Residents Age 55 and Over, 1995

	Number	Number Not Using Safety Equipment	Percent Not Using Safety Equipment
	Fatal Injuries		
All 55+	**601**	**262**	**44%**
55-59	90	42	47%
60+	511	220	43%
	Nonfatal Injuries		
All 55+	**31,961**	**8,342**	**26%**
55-59	8,326	2,229	27%
60+	23,635	6,113	26%

Source: 1995 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions. Statewide Integrated Traffic Records System, Department of California Highway Patrol. Adapted from Tables 4G and 4H, pages 21-22.

Elders report less drinking and driving than younger Californians. Summarizing BRFS data for the period 1984-1997, we find that 0.7 percent of California residents 55 years and older reported drinking and driving, compared to 5.7 percent of those 18-54. Also, among both fatal and nonfatal crash victims, fewer had been drinking compared with younger drivers. With increasing age, the percentage of drivers who had been drinking and involved in collisions falls drastically (Figure B3.5). The percentage rate for drivers under age 55 is three times higher than that for drivers 65 years and older. Another striking feature of Figure B3.5: drinking is about three times more common in fatal than nonfatal crashes in all the age groups.

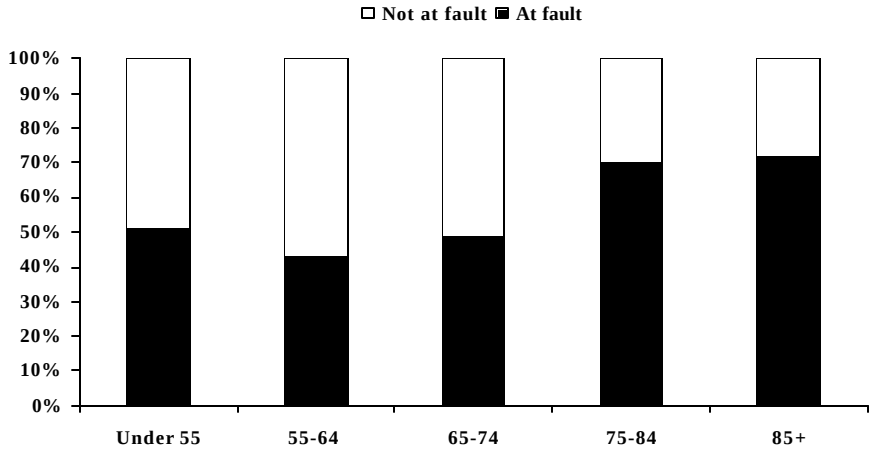
Figure B3.5. Percentage of Drivers Who Had Been Drinking Involved in Fatal and Nonfatal Motor Vehicle Collisions by Age, California Residents Age 55 and Over, 1995



Source: Adapted from Department of California Highway Patrol. 1995 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions. Statewide Integrated Traffic Records System, Table 3C, p.13.

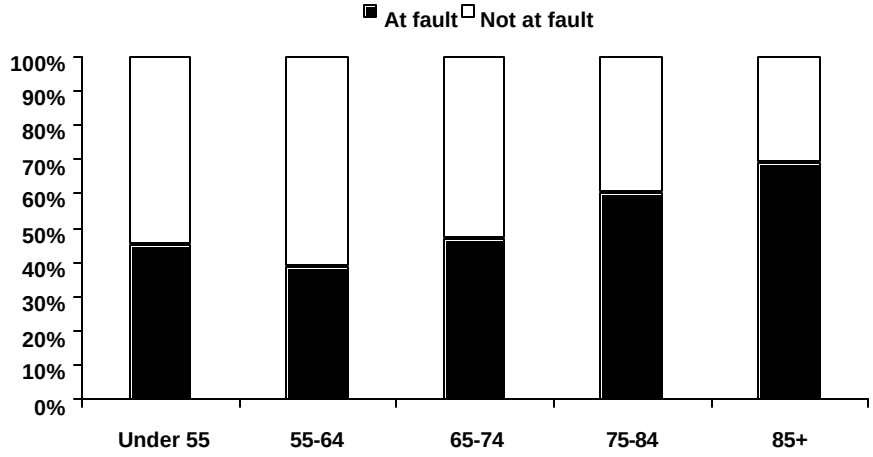
Even though elders have safer driving practices (more safety belt use and less drinking and driving), those age 75 and older are cited more often for being "at fault" in fatal (Figure B3.6) and nonfatal (Figure B3.7) crashes. CHP data demonstrate that the percentage of drivers at fault climbs with advancing age for the oldest age groups.[21] Figure B3.6 compares elder age groups to all drivers under age 55. People in the 55-64 age group make *fewer* errors than younger drivers, perhaps reflecting more conservative driving and more driving experience. It is also possible that this conservative behavior is offset by diminished driving skill with increasing age. Those in the 65-74 age group make about the same percentage of errors as younger drivers (less than 50%). But 70 percent of drivers 75-84 are at fault in fatal car crashes, with the percentage increasing to 72 percent for those 85 years and over. The pattern for nonfatal injury collisions is similar (Figure B3.7). These data indicate that although older drivers apparently follow safer practices, they do not outweigh the effect of diminished driving abilities at higher ages.

Figure B3.6. Drivers at Fault and Not at Fault in Fatal Motor Vehicle Collisions by Age, California Residents Age 55 and Over, 1995



Source: Adapted from Department of California Highway Patrol. 1995 Annual Report of Fatal and Injury Motor Vehicle traffic Collisions. Statewide Integrated Traffic Records System, Table 3C, p.13.

Figure B3.7. Drivers at Fault and Not at Fault in Nonfatal Motor Vehicle Collisions by California Residents Age 55 and Over,



Source: Adapted from Department of California Highway Patrol. 1995 Annual Report of Injury Motor Vehicle traffic Collisions. Statewide Integrated Traffic Records System, Table

County Patterns

Fatal Injuries. Table B3.4 gives fatal injury rates for the victim's county of residence. Rates for only eight counties with 20 or more fatalities from vehicle crashes are given. Kern County has the highest rate, twice that of the statewide rate. Another agricultural county, Fresno, has the second highest rate. Orange County has the lowest rate, followed by Los Angeles County. Nine small population counties in the north and east regions of California had no fatalities, as Table B3.4 shows.

Nonfatal Injuries. Table B3.5 displays victim's county of residence rates for car crash injuries requiring hospital stays. Lake County has the highest rate, followed closely by Alameda County. Santa Barbara County has the lowest rate, followed by Solano and Sonoma Counties.

Table B3.4. Fatal Motor Vehicle Occupant Injury Rates
(per 100,000) by County of Residence,
California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**556**	**9.7**			
Alameda	14	*	Orange	34	7.7
Alpine	0	*	Placer	9	*
Amador	0	*	Plumas	0	*
Butte	3	*	Riverside	31	11.0
Calaveras	3	*	Sacramento	18	8.8
Colusa	1	*	San Benito	3	*
Contra Costa	12	*	San Bernardino	31	13.2
Del Norte	0	*	San Diego	46	9.8
El Dorado	7	*	San Francisco	3	*
Fresno	21	16.6	San Joaquin	18	*
Glenn	0	*	San Luis Obispo	8	*
Humboldt	1	*	San Mateo	8	*
Imperial	8	*	Santa Barbara	7	*
Inyo	4	*	Santa Clara	15	*
Kern	23	22.2	Santa Cruz	1	*
Kings	2	*	Shasta	8	*
Lake	2	*	Sierra	0	*
Lassen	1	*	Siskiyou	3	*
Los Angeles	124	8.0	Solano	7	*
Madera	5	*	Sonoma	6	*
Marin	1	*	Stanislaus	11	*
Mariposa	2	*	Sutter	2	*
Mendocino	3	*	Tehama	3	*
Merced	7	*	Trinity	0	*
Modoc	0	*	Tulare	9	*
Mono	0	*	Tuolumne	3	*
Monterey	4	*	Ventura	17	*
Napa	2	*	Yolo	2	*
Nevada	1	*	Yuba	2	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Table B3.5. Nonfatal Motor Vehicle Occupant Injury Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**4,369**	**76.1**			
Alameda	320	132.9	Orange	346	78.2
Alpine	0	*	Placer	30	71.3
Amador	15	*	Plumas	5	*
Butte	33	63.6	Riverside	216	76.4
Calaveras	11	*	Sacramento	234	113.8
Colusa	1	*	San Benito	5	*
Contra Costa	108	63.0	San Bernardino	220	93.7
Del Norte	1	*	San Diego	398	85.1
El Dorado	31	101.3	San Francisco	94	53.3
Fresno	97	76.5	San Joaquin	49	51.3
Glenn	2	*	San Luis Obispo	32	63.0
Humboldt	18	*	San Mateo	74	50.1
Imperial	20	88.0	Santa Barbara	33	42.7
Inyo	3	*	Santa Clara	145	53.3
Kern	84	80.9	Santa Cruz	17	*
Kings	19	*	Shasta	29	77.2
Lake	24	133.6	Sierra	0	*
Lassen	3	*	Siskiyou	5	*
Los Angeles	1145	73.6	Solano	26	45.9
Madera	13	*	Sonoma	41	47.4
Marin	26	49.9	Stanislaus	62	84.7
Mariposa	2	*	Sutter	9	*
Mendocino	10	*	Tehama	3	*
Merced	30	95.9	Trinity	4	*
Modoc	1	*	Tulare	52	85.7
Mono	1	*	Tuolumne	16	*
Monterey	42	69.7	Ventura	82	65.2
Napa	34	116.9	Yolo	17	*
Nevada	25	100.2	Yuba	6	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Discussion

MV occupant injuries are the second leading fatal and nonfatal injury among the elderly population in California, killing nearly 11 and seriously injuring 84 elders every day. The nonfatal rate has been dropping slightly since 1991, but the fatal rate has remained virtually unchanged since 1985. Seniors most at risk of being involved in both fatal and nonfatal car crashes are whites, males, and those age 75 and over. Rates based on the elder population with drivers licenses show that risk for both fatal and nonfatal injuries increases exponentially for persons 85 years and older. MV occupant injuries will remain an important health issue for seniors since their numbers are expected to increase.

Despite the seriousness of the MV occupant injury problem for California seniors, California has lower fatal injury rates than other states. The United States (U.S.) Department of Health and

Human Services year 2000 objective for fatal MV crashes involving elders ages 70 and over is 20 per 100,000.[23] California, with a 1995 rate of 12.8 for this age group, has already exceeded the national target. California's elders are not unique in falling below the federal target. California also falls below the federal targets for their remaining special population groups for MV occupant fatalities. California's 1995 rate for those under 15 years was 2.2 per 100,000, compared to a target of 4.4. For the 15-24 age group, the California rate was 17.3, compared to a target of 26.8. According to D.O Helmick, CHP Commissioner, 84 percent of California's passengers used safety belts or child safety seats in 1995. Helmick believes that "Use of these [safety] devices has contributed to California having one of the lowest mileage death rates in the nation."[22] By 1998, observed safety restraint use rates in California reached 90 percent, the highest in the U.S.

With restraint use rates so high, there cannot be large variations among age groups. Still, seniors report slightly higher seat belt use than younger adults. Elders engage in some safer driving practices than their younger counterparts. In addition to self-reported seat belt use, elders involved in car crashes are less likely to have been drinking. But the oldest seniors, those 75 and over, are more frequently at fault in both fatal and nonfatal crashes than younger people. This suggests that diminished driving abilities are not offset by safe driving practices.

To reduce MV occupant injuries among older drivers, it is necessary to identify drivers whose abilities have declined to the point that they are at high risk of a crash injury. Currently, the usual renewal period for a driver's license is five years. Applicants who cannot pass the knowledge test after three tries have to reapply. In the re-application, they have to pass both the knowledge test and a driving test. Also, people with an observable impairment and people who fail the visual acuity test must pass both the knowledge test and a driving test. Still, MV occupant fatalities are extremely high after age 80, largely because of the physical frailty of people in this age group. Research is needed to determine whether better screening or testing methods can address the elevated risk among elders 80 and over.

References

1. Wolf ME, Rivara FP. Nonfall injuries in older adults. *Annual Rev Public Health*. 1992;13:509-528.
2. Grisso JA, Schwarz DF, Wishner AR, Weene B, Holmes JH, Sutton RL. Injuries in an elderly inner-city population. *J Am Geriatr Soc*. 1990;38:1326-1331.
3. Massie DL, Campbell KL, Williams AF. Traffic accident involvement rates by driver age and gender. *Accid Anal and Prev*. 1995;27:73-87.
4. Preusser DF, Williams AF, Ferguson SA, Ulmer RG, Weinstein HB. Fatal crash risk for older drivers at intersections. *Accid Anal and Prev*. 1998;30:151-159.
5. Aizenberg R, McKenzie D. Teen and Senior Drivers. California Department of Motor Vehicles and Beverly Foundation, December 1997.
6. Cooper PJ. Differences in accident characteristics among elderly drivers and between elderly and middle-aged drivers. *Accid Anal and Prev*. 1990;22:499-508.
7. Foley DJ, Wallace RB, Eberhard J. Risk factors for motor vehicle crashes among older drivers in a rural community. *J Am Geriatr Soc*. 1995;43:776-781.
8. Marottoli RA, Cooney LM, Wagner R, Doucette J, Tinetti ME. Predictors of automobile and moving violations among elderly drivers. *Ann Intern Med*. 1994;121:842-846.
9. Owsley C, Ball K, McGwin G, Sloane ME, Roenker DL, White MF, Overley ET. Visual processing impairment and risk of motor vehicle crash among older adults. *JAMA*. 1998;279:1083-1088.
10. Levy DT, Vernick JS, Howard KA. Relationship between driver's license renewal policies and fatal crashes involving drivers 70 years or older. *JAMA*. 1995;274:1026-1030.
11. McCloskey LW, Koepsell TD, Wolf ME, Buchner DM. Motor vehicle collision injuries and sensory impairments of older drivers. *Age and Ageing*. 1994;23:267-273.
12. Koepsell TD, Wolf ME, McCloskey L, Buchner DM, Louie D,Wagner EH, Thompson RS. Medical conditions and motor vehicle collision injuries in older adults. *J Amer Geriat Soc*. 1994;42:695-700.
13. Rehm CG, Ross SE. Elderly drivers involved in road crashes: a profile. *Amer Surgeon*. 1995;61:435-437.
14. Gresset J, Meyer F. Risk of automobile accidents among elderly drivers with impairments or chronic diseases. *Canadian J Public Health*. 1994;85:282-285.
15. Ray WA, Fought RL, Decker MD. Psychoactive drugs and the risk of injurious motor vehicle crashes in elderly drivers. *Am J Epidemiol*. 1992;136:873-883.
16. Leveillee SG, Buchner DM, Koepsell TD, et al. Psychoactive medication and injurious motor vehicle collisions involving older drivers. *Epidemiology*. 1994;5:591-598.
17. Hemmelgarn B, Suissa S, Huang A, Boivin JF, Pinard G. Benzodiazepine use and the risk of motor vehicle crash in the elderly. *JAMA*. 1997;278:27-31.
18. Kong LB, Lekawa M, Navarro RA, McGrath J, Cohen M, Margulies DR, Hiatt JR. Pedestrian-motor vehicle trauma: an analysis of injury profiles by age. *J Am Coll Surg*. 1996;182:17-23.
19. Janke MK. Age-Related Disabilities That May Impair Driving and Their Assessment: Literature Review. Research and Development Section, California Department of Motor Vehicles, RSS-94-156, July 1994.

20. Graham JD. Injuries from traffic crashes; meeting the challenge. *Annu Rev Publ Health*. 1993;14:515-543.

21. California Office of Traffic Safety, California Office of Traffic Safety Backgrounder, November 1998, p. 2.

22. Department of California Highway Patrol. 1995 Annual Report of Fatal and Injury Motor Vehicle traffic Collisions. Statewide Integrated Traffic Records System.

23. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives, midcourse revisions. Washington, DC: US Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion; 1994.

Special Topic: Pedestrian vs. Motor Vehicle Injuries

> An 83-year-old man began to cross Wilshire Boulevard at Fairfax Avenue [in Los Angeles] just after the pedestrian signal has turned to 'WALK.' Despite being a healthy and reasonably active man, he walked rather slowly, a characteristic of even normal 83-year-old pedestrians. He was only partly across this six-lane intersection when the flashing 'DON'T WALK' signal began, and he was only two-thirds of the way across when the traffic light changed from orange to red. … An oncoming vehicle … struck him while he was still in the crosswalk … and left him severely injured. He was immediately hospitalized and underwent abdominal exploration for massive internal hemorrhage requiring resection of bowel and repair of lacerations to the liver. He also sustained serious neurological damage, as well as fractures to the right tibia and pelvis. During what eventually became a 4-month hospitalization, he developed aspiration pneumonia, … right deep-vein thrombosis, and pulmonary embolism. … He died during his third hospitalization as a result of severe pneumonia, nine months after the original accident. The Los Angeles Police Department report of this incident noted that at least eight other pedestrians had been reported hit while crossing the same intersection during the last five years.[1]

Crossing the street is dangerous, especially for children and older people. In 1996, an estimated 6,100 pedestrians were killed, and 80,000 were injured by cars, trucks, and other vehicles in the United States (U.S.), according to the National Safety Council.[2] In California for 1995, 278 pedestrians 55 years and over were killed by motor vehicles (MVs) and another 995 received serious injuries requiring hospitalization. (See Tables A1 and A2).

Research on older pedestrians struck by MVs consistently shows that they suffer higher rates of injury and death than young people. Elders hit by MVs tend to end up in intensive care units and require long hospital stays. Compared to other adults and children, seniors also were more prone to chest and pelvic injuries. Their mortality rate was 2.5 times the rate for younger adults and 13 times the rate for children.[3] For pedestrians killed, persons 65 years and over have the highest death rate of any age group.[4]

Why are pedestrian injuries such a problem for older people? There are two answers to this question: (1) they are more likely to be hit by a vehicle and (2) are less likely to recover from their injuries. Consider how aging can increase one's chances of being hit by a vehicle. Sensory deficits, frailty, slow gait, and reduced agility are natural consequences of advancing age. These characteristics make it less likely that elders will be able to perceive danger and react quickly. Also, some elders have to—or choose to—replace driving with walking, putting them at risk of pedestrian injuries. For the most part, intersection crossings are not designed to accommodate older people.[5] Permitting vehicles to right turn on a red light is dangerous for older pedestrians.[4] "Walk" signals do not allow sufficient time to cross the roadway safely, either because of driver impatience or the crosswalk controls are set for a fairly rapid pace.[5] For persons age 72 and over in New Haven, Connecticut, 11 percent reported difficulty in crossing the street, and less than one percent had a normal walking speed sufficient to cross the street in the time allocated.[6] But teams observing pedestrians using crosswalks in Edmonton, Alberta, Canada noted that pedestrians over the age of 50 were the most cautious, especially under dangerous traffic conditions.[7] This vulnerability of seniors is unfortunate since walking, including the ability to cross a street, is necessary to maintain independence.

Pedestrian vs. Motor Vehicle Injury Data[†]

Among California residents 55 years of age or older in 1995, there were 278 fatal MV pedestrian injuries, nearly one each day (Table B4.1). There were also 995 injuries serious enough to require hospitalization, nearly three each day. Combining the nonfatal and fatal cases into total serious injuries, we see that 22 percent of elders pedestrian struck by vehicles died.

Table B4.1. Fatal and Nonfatal Pedestrian vs. Motor Vehicle Injuries by Sex, Age, and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Fatal				Nonfatal			
	Number	Percent	Rate per 100,000	95% C.I.	Number	Percent	Rate per 100,000	95% C.I.
All	**278**	**100**	**4.8**	**4.3 – 5.4**	**995**	**100**	**17.3**	**16.2 – 18.4**
Sex								
» Male	169	61	6.6	5.6 - 7.6	454	46	17.8	16.2 - 19.4
» Female	109	39	3.4	2.8 - 4.1	541	54	16.9	15.5 - 18.4
Age Group								
» 55-64 Years	86	31	3.7	2.9 - 4.5	313	31	13.5	12.0 - 15.0
» 65-74 Years	83	30	4.2	3.3 - 5.2	338	34	17.3	15.5 - 19.1
» 75-84 Years	78	28	7.0	5.4 - 8.5	253	25	22.5	19.8 - 25.3
» 85 Years +	31	11	8.8	5.7 - 11.8	91	9	25.7	20.4 - 31.0
Race/Ethnicity**								
» White	140	50	3.4	2.9 - 4.0	580	58	14.2	13.1 - 15.4
» Black	21	8	6.6	3.8 - 9.5	72	7	22.8	17.5 - 28.1
» Hispanic	68	24	8.3	6.3 - 10.2	164	16	19.9	16.9 - 23.0
» Asian/Pacific Islander	46	17	9.1	6.5 - 11.8	132	13	26.2	21.7 - 30.7
» Other	3	1	*	*	26	3	85.2	52.5 - 118.0

Note: Percentages may not actually add up to 100 because of independent rounding.

* Rates were not computed for fewer than 20 cases.

** 21 nonfatal cases with unknown race/ethnicity not included here.

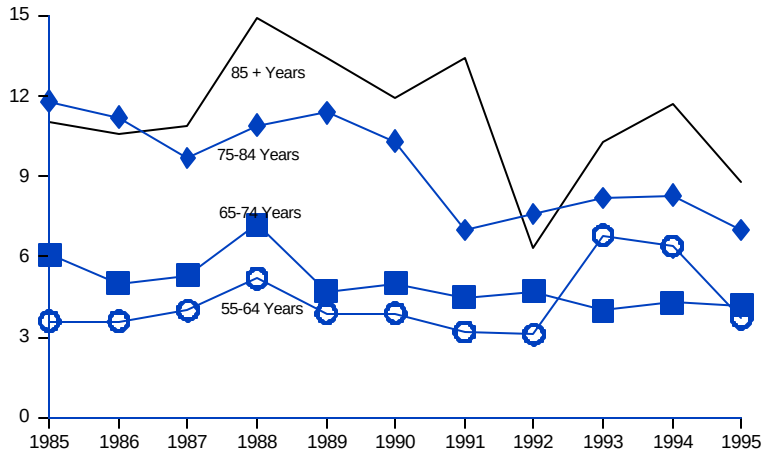
Source: California Department of Health Services, death records, and California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Trends

Fatal Injuries. Fatal pedestrian injury rates (per 100,000) for the 11-year period, 1985-1995 are displayed on Figure B4.1. Despite fluctuation during this period, the average annual rate fell slightly (-1.8%) for all elders (data not shown). The youngest and oldest age groups experienced average annual rate increases in fatal pedestrian injuries during the 11-year period (6.6% and 2.6%), but the 65-74 and 75-84 age groups experienced declines (-2.1% and -4.1%).

[†] We examine pedestrian vs. MV ("pedestrian" hereafter) injury patterns and trends by identifying computerized hospital discharge records and death certificates where the external cause of injury or the underlying cause of death is coded "motor vehicle traffic accidents." We analyzed ICD-9 code series E810-E819, identifying pedestrians as the injured person (4th digit equal to 7). For nonfatal hospitalized cases, we eliminate duplication with fatal cases by removing persons who died in the hospital.

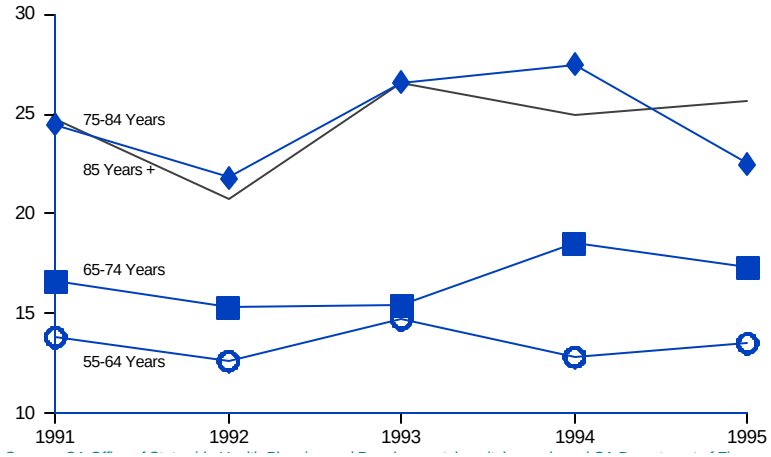
Figure B4.1. Fatal Pedestrian vs. Motor Vehicle Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1985-1995



Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Nonfatal Injuries. Figure B4.2 shows hospitalized, nonfatal pedestrian injury rates (per 100,000) for the 5-year period, 1991-1995. The trend line for all elders showed some fluctuation, but no significant overall change (data not shown). As was true for fatalities, the youngest and oldest age group experienced increases in average annual rates (0.2% and 2.2%), while the 65-74 and 75-84 age groups experienced decreases (1.6% and 1.0%).

Figure B4.2. Nonfatal Pedestrian vs. Motor Vehicle Injury Rates (per 100,000) by Age, California Residents Age 55 and Over, 1991-1995



Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Sex, Age, and Race/Ethnicity Patterns

Fatal Injuries. Table B4.1 shows demographic risk patterns for elder pedestrian fatalities. The male death rate is nearly twice that of females, a statistically significant difference. Age is a strong risk factor. Fatality rates increase with advancing age. The rate for the oldest group is more than double the rate for the near old 55-64 age group, a statistically significant difference. Whites, with a majority of fatalities, have the lowest rate. The rates for Hispanics and Asians are about 2.5 times the rate for whites, a statistically significant difference.

To determine whether whites have lower rates across socioeconomic status (SES), we created Table B4.2. All nonwhites were combined to produce numbers large enough to calculate rates. Educational attainment profoundly affects risk of pedestrian injury death. The rate among elders with less than a high school education is 4 times the rate among those with more than a high school education. The strong effect of education holds for both whites and others, indicating that whites do not have lower rates simply because of higher SES, as measured by educational attainment. Both race/ethnicity and educational attainment have a strong, separate effect on pedestrian death rates.

Table B4.2. Fatal Pedestrian vs. Motor Vehicle Injury Rate (per 100,000) by Educational Attainment and Race/Ethnicity, California Residents Age 55 and Over, 1995

	Total		< 12 Years		12 Years		> 12 Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Total	**4.8**	**4.3 – 5.4**	**8.8**	**7.2 – 10.4**	**5.0**	**4.0 – 6.1**	**2.2**	**1.7 – 2.8**
White	3.4	2.9 - 4.0	6.7	4.5 - 8.8	4.1	3.0 - 5.2	1.8	1.2 - 2.3
Nonwhite	7.9	6.5 - 9.2	10.4	8.1 - 12.7	8.7	5.7 - 11.7	4.0	2.3 - 5.7

Note: Educational attainment is used as a proxy for socioeconomic status.

Source: Numerators from California Department of Health Services, death records, and denominators from UCLA Center for Health Policy Research estimates, June 1998.

Nonfatal Injuries. A majority of elders hospitalized for pedestrian injuries are women, although the rate for men is slightly higher (Table B4.1). Like fatalities, nonfatal injury rates increase with advancing age. The rate for the oldest group is nearly double that of the youngest 55-64 age group. All of the rate differences are statistically significant, except the difference between the 75-84 and 85 and older age groups. The white rate is significantly lower than any other race/ethnic group. The comparatively small "Other" group, made up of Native Americans, Eskimos, and Aleuts, had an extremely high rate.

County Patterns

Fatal Injuries. Table B4.3 shows fatal injuries for the victim's county of residence. Los Angeles County had the largest number of fatalities, 37 percent of the statewide total, and was the only county with enough cases (20 or more) to compute a rate. The rate for Los Angeles was higher than the statewide rate. During 1995, no pedestrians were killed by vehicles in 28 counties.

Do elder pedestrian injuries occur more often in urban than rural places? We grouped counties into three categories according to the county's percentage of population living in urban places (see Methods and Data Appendix), and calculated pedestrian injury rates. (Low percentage urban, or rural counties, had only a few pedestrian fatalities so we combined this category with

medium percentage urban.) The rates were 5.2 per 100,000 for highly urban counties, versus 3.0 for the combined category of all remaining counties.

Nonfatal Injuries. Table B4.4 displays victims' county of residence rates for pedestrian injuries requiring hospital stays. San Francisco has the highest rate for residents being hospitalized after being hit by a MV, nearly four times higher than the state rate. Los Angeles, Alameda, and Sacramento Counties also had nonfatal rates that were higher than the statewide rate. San Bernardino County had the lowest rate.

Do urban places have more pedestrian injuries than other places? The nonfatal injury rates were 19.0 per 100,000 for highly urban counties and 9.3 for all remaining counties. (The low percentage urban, or rural, counties had too few nonfatal, hospitalized injuries to calculate a rate for this category. So we combined low and medium percentage urban counties.)

Table B4.3. Fatal Pedestrian vs. Motor Vehicle Injury Rates
(per 100,000) by County of Residence,
California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**278**	**4.8**			
Alameda	13	*	Orange	19	*****
Alpine	0	*	Placer	0	*
Amador	0	*	Plumas	0	*
Butte	0	*****	Riverside	9	*****
Calaveras	0	*	Sacramento	9	*
Colusa	0	*	San Benito	0	*
Contra Costa	3	*	San Bernardino	17	*
Del Norte	0	*	San Diego	19	*
El Dorado	0	*	San Francisco	19	*****
Fresno	5	*	San Joaquin	9	*
Glenn	0	*	San Luis Obispo	0	*
Humboldt	1	*	San Mateo	5	*
Imperial	1	*	Santa Barbara	3	*
Inyo	1	*	Santa Clara	12	*
Kern	6	*	Santa Cruz	0	*
Kings	0	*	Shasta	3	*
Lake	0	*	Sierra	0	*
Lassen	0	*	Siskiyou	0	*
Los Angeles	102	6.6	Solano	1	*****
Madera	1	*	Sonoma	3	*
Marin	2	*	Stanislaus	3	*
Mariposa	0	*	Sutter	0	*
Mendocino	2	*	Tehama	0	*
Merced	0	*	Trinity	0	*
Modoc	0	*	Tulare	4	*
Mono	0	*	Tuolumne	0	*
Monterey	0	*	Ventura	2	*****
Napa	2	*	Yolo	1	*
Nevada	1	*	Yuba	0	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Table B4.4. Nonfatal Pedestrian vs. Motor Vehicle Injury Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**995**	**17.3**			
Alameda	51	21.2	Orange	56	12.7
Alpine	0	*	Placer	0	*
Amador	1	*	Plumas	0	*
Butte	3	*	Riverside	34	12.0
Calaveras	0	*	Sacramento	43	20.9
Colusa	0	*	San Benito	2	*
Contra Costa	18	*	San Bernardino	24	10.2
Del Norte	3	*	San Diego	64	13.7
El Dorado	6	*	San Francisco	113	64.1
Fresno	17	*	San Joaquin	11	*
Glenn	0	*	San Luis Obispo	9	*
Humboldt	1	*	San Mateo	24	16.2
Imperial	2	*	Santa Barbara	9	*
Inyo	0	*	Santa Clara	42	15.4
Kern	6	*	Santa Cruz	7	*
Kings	2	*	Shasta	3	*
Lake	1	*	Sierra	0	*
Lassen	0	*	Siskiyou	0	*
Los Angeles	368	23.7	Solano	6	*
Madera	0	*	Sonoma	9	*
Marin	7	*	Stanislaus	6	*
Mariposa	0	*	Sutter	2	*
Mendocino	1	*	Tehama	0	*
Merced	3	*	Trinity	0	*
Modoc	0	*	Tulare	2	*
Mono	0	*	Tuolumne	0	*
Monterey	9	*	Ventura	11	*
Napa	6	*	Yolo	8	*
Nevada	1	*	Yuba	4	*

* Rates were not computed for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Discussion

Pedestrian injuries are an important cause of death and hospitalization among older Californians. Each day three to four persons are killed or hospitalized because of such incidents. The fatal rate has declined slightly since 1985, but the nonfatal rate has remained virtually unchanged since 1991. Nonwhites, males, and persons 75 years and over are most at risk of pedestrian injuries. White pedestrians are killed by MVs at a lower rate than nonwhites at every education level, and fatalities fall as education rises for both whites and other ethnicities. San Francisco and Los Angeles Counties have high rates of both fatal and hospitalized nonfatal pedestrian injuries for older Californians. San Bernardino County has the lowest rate. Consistent with other studies, rates are higher in urban areas.[8] But elders always have the highest fatal and nonfatal pedestrian injury rates, even in demographic groups or counties with low rates.

The U.S. Department of Health and Human Services has a year 2000 objective for fatal pedestrian injuries for all ages (2 per 100,000), but none for the two groups at highest risk: young children and older adults.[9]

Specific interventions can reduce pedestrian injuries, studies and experiences in communities have demonstrated. Providing more crossing time at intersections, particularly those in areas with large elderly populations, is an effective intervention to reduce pedestrian injuries.[1,6] Not permitting drivers to turn right on a red light in areas frequented by older persons would also reduce risk.[4] Another successful strategy has been for communities to identify high risk areas and then implement environmental changes specific to the needs in those areas. For example, many cities have instituted traffic-calming measures, such as reduced speed limits and one-way streets, which will make crossing the street safer for people of all ages. Other traffic control measures, such as surveillance cameras to reduce red-light running and lights to indicate the presence of a pedestrian in a crosswalk, may also help.

References

1. Hoxie RE, Rubenstein LZ, Hoenig H, Galagher BR. The older pedestrian. *J Amer Geriatr Society*. 1994;42:444-450, p. 444.
2. National Safety Council. *Accident Facts, 1997 Edition*. Itasca, IL
3. Kong LB, Lekawa M, Navarro RA, McGrath J, Cohen M, Margulies DR, Hiatt JR. Pedestrian-motor vehicle trauma: an analysis of injury profiles by age. *J Am Coll Surg*. 1996;182:17-23.
4. Wolf ME, Rivara FP. Nonfall injuries in older adults. *Annual Rev Public Health*. 1992;13:509-528.
5. Harruff RC, Avery A, Alter-Pandya AS. Analysis of circumstances and injuries in 217 pedestrian traffic fatalities. *Accid Anal and Prev*. 1998;30:11-20.
6. Langlois JA, Keyl PM, Guralnik JM, Foley DJ, Marottoli RA, Wallace RB. Characteristics of older pedestrians who have difficulty crossing the street. *Am J Public Health*. 1997;87:393-397.
7. Harrell WA. The safety of older pedestrians at signal-controlled crossings. *Intl J Aging and Human Development.* 1996;42:65-79.
8. Baker SP, O'Neill B, Ginsburg MJ, Li G. *The Injury Fact Book*. Oxford University Press: New York, 1992.
9. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives, midcourse revisions. Washington, DC: US Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion; 1994.

Special Topic: Suicide

Ask, "What kind of injury kills more elder people than any other?" and few people would answer "suicide." Suicide is so common among elders that the media seldom say much about it, focusing instead on rarer but more newsworthy youth suicide.[1-3] As the elderly constitute the fastest growing age group in the United States (U.S.), the number of elder suicides is expected to increase.[1,3]

Suicide trends are poorly understood. For elders, rates in the U.S. have drifted up and down for no apparent reason.[3-4] But for 1970-1990, rates climbed in every state except California where rates dropped. Better record keeping in California may account for this in part, but no one can be absolutely certain.[5]

Demographic risk factors for suicide are well known. Among the elderly, rates are always higher among males, whites, the divorced and widowed, and people in their seventies and beyond.[1-3,6-7] Suicide risk is also increased by depression, alcohol and drug abuse, physical decline, sickness and pain, economic problems, retirement-related difficulties, loneliness, recent loss of a significant other, loss of independence, and by a previous suicide attempt.[2,6,8] In the U.S., at all ages, guns are the most common suicide method, followed by hanging and poisoning. The rising use of guns has been an important factor in the rising suicide rate among the elderly.[3]

Suicide Data†

Among California residents 55 years of age and over in 1995, there were 1,148 suicides, or just over three each day (Table B5.1). The most commonly used mechanisms are guns (61%), followed by hanging and suffocation (15%) and poisoning (12%) (Table B5.1).

Table B5.1. Suicide by Mechanism of Suicide,
California Residents Age 55 and Over, 1995

	Number	Percent
All Suicide	**1,148**	**101**
Firearms	698	61
» Handgun	400	35
» Shotgun	52	4
» Hunting Rifle	42	4
» Unspecified Firearm	204	18
Hanging & Suffocation	173	15
» Hanging	110	10
» Suffocation by Plastic Bag	62	5
» Other	1	0
Poisoning	133	12
All Other	144	13

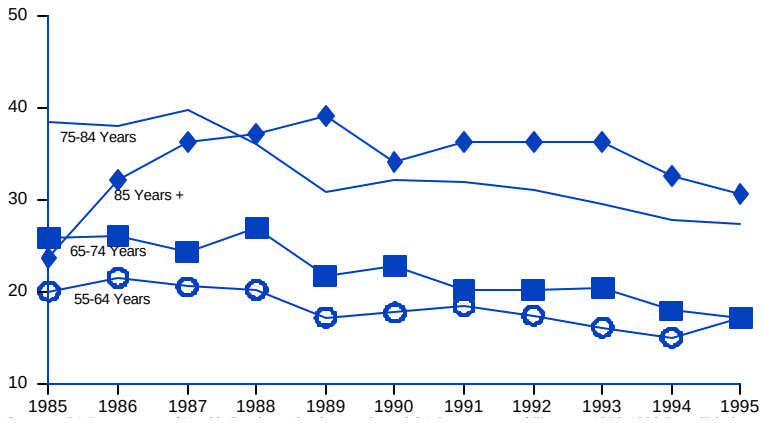
Source: California Department of Health Services, death records.

† We examine suicide patterns and trends by looking at computerized death certificates where the underlying cause of death is coded "suicide" (ICD-9 codes E950-E959).

Trends

Suicide rates (per 100,000) for the 11-year period 1985-1995 appear in Figure B5.1. Rates have declined slightly for all elder age groups except the oldest. The average annual rate decline was -0.6 percent for near elderly persons age 55-64, -3.6 percent for persons age 65-74, and -3.1 percent for persons age 75-84. In contrast, for persons 85 years and over, rates rose from 23.7 in 1985 to 39.1 in 1989 and then declined to 30.5 in 1995, the average annual rate increase was 3.3 percent.

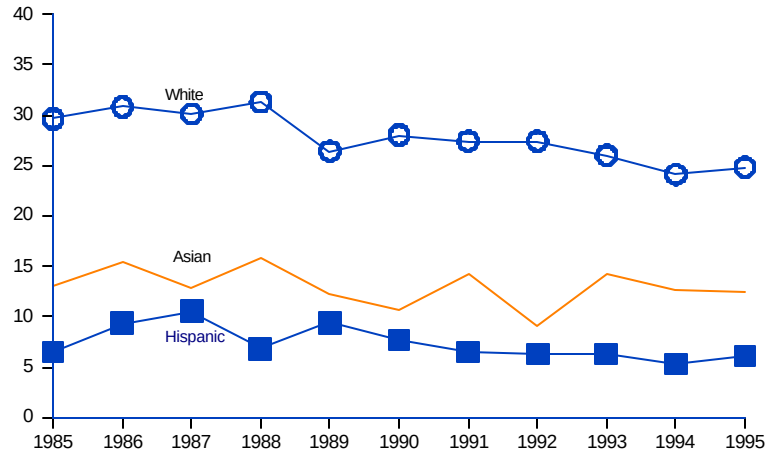
Figure B5.1. Suicide Rates (per 100,000) by Age Group, California Residents Age 55 and Over, 1985-1995



Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Trends for race/ethnic categories are shown in Figure B5.2. (We do not show rates for blacks because the number of suicides fell below 20 cases in 1985 and 1991.) For whites, although rates fell unevenly from 29.6 for 1985 to 24.8 for 1995, the average yearly rate decline was only -1.6 percent. For Hispanics, rates climbed from 6.5 in 1985 to 10.5 in 1987 and then fell unevenly to 6.1 in 1995. But the average annual rate increase was 2.1 percent. Similarly, for Asians, rates jumped from 13.1 in 1995 to 15.8 in 1988 and then declined unevenly to 12.5 in 1995. Because of all the year-to-year variation, Asians registered a modest increase of 3.1 percent in average annual rate over 1985-1995.

Figure B5.2. Suicide Rates (per 100,000) by Race/Ethnicity, California Residents Age 55 and Over, 1985-1995



Note: Graph does not include data for other and unknown race/ethnicity.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Sex, Age, and Race/Ethnicity Patterns

Demographic risk patterns for elder suicide are displayed in Table B5.2. The strongest risk factor is sex, with three-fourths of the suicides committed by men. The male rate is four times that of females, a statistically significant difference. Rates are also significantly higher for persons 75 years and older. When broken down by race/ethnicity, whites have the highest rate, which is almost twice as high as the rate for Asians, three times as high as the rate for blacks, and four times as high as the rate for Hispanics.

Table B5.2. Suicide by Sex, Age, and Race/Ethnicity,
California Residents Age 55 and Over, 1995

	Number	Percent	Rate per 100,000	95% C.I.
All	**1,148**	**100**	**20.0**	**18.8 – 21.1**
Sex				
» Male	874	76	34.3	32.0-36.5
» Female	274	24	8.6	7.5-9.6
Age Group				
» 55-64 Years	397	35	17.1	15.5-18.8
» 65-74 Years	335	29	17.1	15.3-19.0
» 75-84 Years	308	27	27.4	24.4-30.5
» 85 Years +	108	9	30.5	24.8-36.3
Race/Ethnicity				
» White	1,009	88	24.8	23.2-26.3
» Black	24	2	7.6	4.6-10.6
» Hispanic	50	4	6.1	4.4-7.8
» Asian/Pacific Islander	63	5	12.5	9.4-15.6
» Other	2	*	**	**

* Less than .05 percent.

** Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Populations Estimates, January 1998.

Do whites continue to have the highest suicide rates at different socioeconomic status (SES) levels? Using educational attainment as a measure of SES, we find that the answer is "yes." In order to obtain numbers large enough to compute rates, we combined black, Hispanic, and Asian into "nonwhite." For both whites and nonwhites, high school graduates had the highest rates, followed closely by elders with some high school, and those with at least some college had the lowest rates. Whites have significantly higher rates of suicide at each educational level (Table B5.3). The suicide rate for white elders attaining some high school or high school graduation was three times higher than the rate for nonwhites, with the difference increasing to 3.4 times higher at the some college or above level. This means that differences in rates of suicide rise somewhat between whites and nonwhites with increasing educational attainment.

Table B5.3. Suicide Rate (per 100,000) by Educational Attainment and Race/Ethnicity,
California Residents Age 55 and Over, 1995

	Total		< 12 Years		12 Years		> 12 Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Total	**20.0**	**18.8 – 21.1**	**17.6**	**15.3 – 19.8**	**24.6**	**22.2 – 27.0**	**16.4**	**14.8 – 17.9**
White	24.8	23.2 - 26.3	28.6	24.2 - 33.0	29.6	26.6 - 32.6	18.8	17.0 - 20.5
Nonwhite	8.1	6.8 - 9.5	9.2	7.0 - 11.3	9.8	6.6 - 13.0	5.6	3.6 - 7.6

Note: Educational attainment is used as a proxy for socioeconomic status.

Source: Numerators from California Department of Health Services, death records, and denominators from UCLA Center for Health Policy Research estimates, June 1998.

County Patterns

Table B5.4 presents rates for the counties where suicide victims lived. Rates are shown for only 13 counties, since 45 counties had fewer than 20 suicides in 1995. San Francisco had the highest rate (nearly 1.5 times the statewide rate), followed by Sacramento County. Contra Costa County has the lowest rate. Although Los Angeles County has the largest number of suicides, its rate is lower than the statewide rate.

Table B5.4. Suicide Rates (per 100,000) by County of Residence, California Residents Age 55 and Over, 1995

	Number	Rate		Number	Rate
Statewide	**1,148**	**20.0**			
Alameda	44	18.3	Orange	76	17.2
Alpine	0	*	Placer	11	*
Amador	0	*	Plumas	3	*
Butte	14	*	Riverside	70	24.8
Calaveras	3	*	Sacramento	52	25.3
Colusa	1	*	San Benito	0	*
Contra Costa	25	14.6	San Bernardino	47	20.0
Del Norte	5	*	San Diego	116	24.8
El Dorado	9	*	San Francisco	50	28.4
Fresno	20	15.8	San Joaquin	16	*
Glenn	0	*	San Luis Obispo	12	*
Humboldt	7	*	San Mateo	32	21.7
Imperial	4	*	Santa Barbara	16	*
Inyo	1	*	Santa Clara	41	15.1
Kern	22	21.2	Santa Cruz	6	*
Kings	3	*	Shasta	8	*
Lake	10	*	Sierra	0	*
Lassen	2	*	Siskiyou	3	*
Los Angeles	272	17.5	Solano	5	*
Madera	7	*	Sonoma	19	*
Marin	12	*	Stanislaus	10	*
Mariposa	0	*	Sutter	3	*
Mendocino	6	*	Tehama	3	*
Merced	5	*	Trinity	3	*
Modoc	0	*	Tulare	19	*
Mono	0	*	Tuolumne	1	*
Monterey	16	*	Ventura	13	*
Napa	7	*	Yolo	9	*
Nevada	7	*	Yuba	2	*

* Rates were not computed for fewer than 20 cases.

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Discussion

Suicide is the leading fatal injury among the elderly population in California and the U.S. as a whole, disproportionately killing males and whites and most often involving a firearm.[1-3,6] The California rate has been decreasing slightly since 1985 for persons 55 years and older. The U.S. Department of Health and Human Services has set a year 2000 objective for white males

age 65 and over at 39.2 per 100,000.[9] The California rate for this group was 49.2 in 1995. California will not meet this objective unless this rate drops precipitously.

The future of elder suicide in California depends on how it is viewed and whether we can take effective action to reduce rates. Americans have very mixed feelings about suicide. There is a growing movement to make suicide a choice for people with terminal illnesses. Physician-assisted suicide now has some legal protection in several states (but not California). Proponents argue that the elderly deserve autonomy and the option of suicide "because of a lifelong pattern of learning that gives them the necessary perspective to decide what kind of life they want and…don't want" (p.365).[10] Many, including much of the disability and hospice communities, argue that society should not simply permit people with medical problems to destroy themselves. Rather, we should try harder to alleviate pain and to give elders more to live for.

Another position is the Judaic-Christian prohibition of suicide, embodied in our statutes and case law. Consistent with this position is the physician's oath of Hippocrates, which many interpret to mean that physicians must do "no harm" and not help people commit suicide, even if patients face certain and painful death.

Some argue that if we did our best to reduce the impetus to suicide? isolation, loss, and unbearable pain? that most people would elect to live as long as they can. "Death by one's hand is premature at any age and the premature deaths of older adults constitute a loss of talent and resources that no society can accept. We must improve and increase our efforts to prevent and reduce such avoidable tragedies and enhance the lives of elders…" (pp.190-191).[2] This position is compatible with the public health approach to suicide prevention.

Some feel an effective intervention is to limit access to guns.[11-12] "As elders frequently use violent means to commit suicide, gun control may especially impact suicide rates in the elderly (p. 178)."[6] An unanswered question is whether, in the absence of a gun, elders will substitute another highly lethal method.

References

1. McIntosh JL. Epidemiology of suicide in the elderly. *Suicide Life Threat Behav*. 992;22:15-35.
2. McIntosh JL. Suicide prevention in the elderly 65-99). *Suicide Life Threat Behav*. 1995;25:180-192.
3. *MMWR*. Suicide among older persons. United States. 1980-1992. 1996;45:3-6.
4. Otten AL. Suicides rise among the oldest and youngest. *Wall Street Journal*. Friday, November 4, 1994.
5. Males M. California's suicide decline, 1979-1990 *Suicide Life Threat Behav.* 1994;24:24-37.
6. Blazer D. Suicide risk factors in the elderly: an epidemiological study*. J Geront Psychiatr*., 1991;24:175-190
7. Shiang J, Blinn R, Bongar B, Stephens B, Allison D, Schatzberg A. Suicide in San Francisco, CA: a comparison of Caucasian and Asian groups. *Suicide Life Threat Behav*. 1997;27:80-91.
8. Rich CL, Warsradt GM, Nemiroff RA, Fowler RC, Young D. Suicide, stressors, and the life style. *Am J Psychiatry*. 1991;148:524-527.
9. Public Health Service. Health people 2000: national health promotion and disease prevention objectives, midcourse revisions. Washington, DC: US Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion; 1994.
10. Carpenter BD. A review and new look at ethical suicide in advanced age. G*erontologist.*1993;33:359-365.
11. Kellermann AL, Rivara FP, Rushfort NV, et al. Gun ownership as a risk factor for homicide in the home*. N Engl J Med.* 1993;329:1084-1091.
12. Brent DA, Perper JA, Allman CJ, Moritz GM, Wartella ME, Zelenak JP. The presence and accessibility of firearms in the homes of adolescent suicide? a case-control study. *J Amer Med Assoc*. 1991;261:2989-2995.

Important Methodological Note

The Centers for Disease Control and Prevention's (CDC) National Center for Injury Prevention and Control has developed a provisional standardized framework of external cause of injury (E-code) groupings to be used nationwide. The framework is a matrix, displaying E-code groupings (in rows) by intentionality (in columns). The intentionality columns are suicide, homicide, undetermined, other, and unintentional. CDC is now looking at the value of the matrix approach in tabulating injury data, and we anticipate a final nationwide standard in the near future.

Until now, California and other states used their own classification schemes. This is the first *EPIC Proportions* report to use the new matrix concept, with modifications, so that our data will be comparable to other state and federal data. Tables A1 (fatality data) and A2 (morbidity data) display our adaptation of the federal matrix. Appendix Tables A1 (fatality data) and A2 (morbidity data) give California's original injury classification framework to permit comparison between the old and new methods of classifying injury.

How has California modified the CDC matrix?

We have:

- collapsed the matrix into one column since cross-classifying cause of injury by intentionality leaves many blank cells in the matrix (for example, virtually all motor vehicle (MV) injuries are unintentional),
- combined conditions occurring at any time after the acute injury, or late effects, in one grouping so that injury incidence can be computed (rather than including late effects in each intentionality column),
- deleted newborns who have been injured or died before leaving the hospital (rather than including them) since these are either coding errors or iatrogenic injuries,
- deleted place of injury codes (E849) (since they are basically errors),
- distributed homicide and suicide into major components (as the matrix does for MV traffic injuries and natural/environmental injuries), and
- added "other MV" and "other environmental injuries" so that the components of these two groupings will sum to the subtotals.

How do the numbers differ using California's original (old) and the new CDC classifications?

The differences in the grand totals between the CDC and California injury classification schemes are small: one for fatal (3,916 in Table A1 vs. 3,915 in Appendix Table A1) and 30 for nonfatal (85,640 in Table A2 vs. 85,610 in Appendix A2) injuries. Why the differences? The new CDC classification includes war injuries, but our original classification does not. For most injury groupings or categories, the numbers are the same. If you look at drowning and submersion, or add the components of homicide and suicide in Tables A1 or A2, and compare them to the same categories in Appendix Table A1 or A2, the numbers are identical. Looking at the major differences for specific fatal and nonfatal injuries, the largest differences are found in falls, MV occupant and MV pedestrian injuries. We give the details below.

Falls. The numbers of fatal falls are fewer in the new, compared to the old, classification (764, Table A1, vs. 823, Appendix Table A1, for fatal and 59,481, Table A2, vs. 60,531, Appendix

Table A2, for nonfatal). Why? The old includes E887, fracture with cause unspecified, a code located among those for falls, whereas the new classification assigns this code to "unspecified."

MV occupant injuries. The fatal injuries are 556 for the new and 640 for the old systems. The nonfatal injuries are 4,369 for the new and 4,609 for the old classification schemes. Three major coding differences account for the different numbers. The new system lumps unspecified persons into an unspecified category, but the old system includes them in MV occupant injuries. Injuries caused by boarding or alighting MVs are part of MV occupant in the new, but are included in other transport in the old system. The new system includes nontraffic injuries in other transport, but they are part of MV occupant injuries in the old classification.

MV pedestrian injuries. The old system results in more fatal cases (305) and nonfatal cases (1,060) than the new system (271 and 995). The old includes codes for MV nontraffic incidents involving pedestrians, but the new includes them in "pedestrian, other." In other words, the new system does not include nontraffic injuries to pedestrians as MV pedestrian injuries, but the old one does.

While our original classification has the advantage of being parsimonious, the new classification adds many new injury categories. By necessity, the matrix framework moves all injuries of undetermined intent into nonspecific categories, instead of retaining them in the cause of injury categories. We depart from the CDC method of combining late effects with the causes of injury, since this method disallows the calculation of incidence. But our modification, combining all late effects in one category, permits unduplicated counts of injuries. This is a prerequisite for surveillance.

Appendix

Methods and Data

Definitions

In this report, the words “Elder” and “Senior” are used interchangeably to describe all California residents 55 years of age and older. We use standard National Center for Health Statistics age groups: 55-64, 65-74, 75-84, and 85 and over. The “near old” 55-64 age group can be looked at as a “baseline” for the aging process.

“Serious injuries” are defined as either a death or a hospitalization of a California resident where the principal external cause of injury falls in the International Classification of Diseases, Ninth Revision (ICD-9), code range E800-E999. (Exclusions are discussed below.) Specific definitions (external cause of injury or E-codes) for the causes of injuries used in special topics appear in the Data section for each topic. Injuries treated in hospital emergency rooms, doctors’ offices or clinics, at home or other places are not included in this report because this information is not yet gathered statewide.

We do not consider certain E-code categories to represent true injuries, and we exclude them from analysis. Specifically, we exclude medical misadventures, postoperative complications, and adverse effects of drugs, medicinal, and biological substances. For all but total charges data, hospital patients who die in the hospital are excluded to eliminate the duplication between morbidity (hospital discharge) and mortality data. This allows us to compute fatal and nonfatal incidence rates which do not count a given injury episode more than once.

"Hospital charges" cover all services performed during the initial hospitalization, except physicians' fees, for the first 365 days. Charges overstate actual revenue to the hospital since not all bills are collectable. Data were imputed for 6,803 cases (8%) where charges were not reported. The largest portion of these were Medicare cases (5,368 or 79% of exclusions). Mean charges for Medicare patients were substituted for unknown and unreported codes in the dataset. Expected principal source of payment designates the expected payer at admission, which may differ from the actual payer at discharge. Length of stay is the number of days from admission to discharge.

Statistics

Rates and other population-based numbers inevitably contain some random errors. To help decide whether differences are large enough to be considered more than mere error, we include 95 percent confidence intervals (C.I.) where appropriate. These intervals say that the probability is 95 percent that the actual rate falls within the interval. For example, the rate for all fatal falls in Table B2.2 is 13.3, and the upper and lower 95 percent confidence limits are 12.4 and 14.2, which means we can be 95 percent confident that the true value lies within this interval. Differences between rates are statistically significant when their C.I.s do not overlap. On Table B2.2, for example, we can see that the male rate for fatal falls is significantly higher than the female rate because their C.I.s (14.0-17.1 for males and 10.3-12.7 for women) do not overlap.

Data and Data Sources

1. Fatal Injuries. This study uses 1995 California Vital Statistics Death Records of the Department of Health Services (DHS). E-codes (the principal external cause describing the mechanism that caused the most severe injury or adverse effect) are located in the ICD-9 variable. Other variables used are: race/ethnicity and Hispanic origin, age, county of residence, and educational attainment. Race/ethnicity is not always obtained from the victim's family and, therefore, should be interpreted with caution.

2. Hospitalized Nonfatal Injuries. Hospital discharge files provided by the California Office of Statewide Health Planning and Development (OSHPD) are the second major data source used. A total of 553 nonfederal hospitals licensed to provide inpatient services in California in 1995 reported data for 3.6 million discharges. Calendar year 1995 is the fifth complete year that hospitals have been required to report E-codes. Since an E-code is required only for the hospitalization during which the injury was first diagnosed and treated, E-coded discharge records contain hospitalized injury incidence data. OSHPD's reabstraction studies of hospital records have shown the reliability of most variables used in this study to be good. To ensure quality assurance for the relatively new E-coded data, both computerized and analyst edits are performed on every record from every hospital reporting to OSHPD. In addition to E-code, other hospital discharge data set variables are: age, gender, race/ethnicity, county of residence, principal diagnosis, hospital charges, expected principal source of payment, and length of stay.

3. Denominator and Other Data. California Department of Finance population projections served as denominators for computing injury rates. The race/ethnicity categories in this source are white, black, Hispanic, Asian/Pacific Islander, and others. Our study period, 1995, was the first year for which we could analyze Asians separately from others. We shorten "Asian/Pacific Islander" to "Asians" in the text but not in the tables. In order to be able to compute rates for educational attainment (which we used as a surrogate for socioeconomic status), we contracted with the University of California at Los Angeles Center for Health Policy Research to estimate population data. The Center used March 1997 Current Population Survey data, conducted by the United States Census Bureau, to develop the estimates.

We also developed statistical tables from three other sources:

- The Department of California Highway Patrol (CHP) report, *1995 Annual Report of Fatal and Injury Motor Vehicle (MV) Traffic Collisions*, provided data on safety belt and passive restraint use in our MV Occupant special topic. In these data, all persons 60 years and above are grouped in one category. The CHP reports fewer deaths than in California Vital Statistics Death Records, and a greater number of nonfatal injuries than in hospital discharge data, because of differences in the definition of "injury." These differences are discussed in the introduction to the special topic on MV Occupant Injury.
- The DHS, Linked Data File, 1990-1995 was used for perpetrator data for homicides in our Assault/Homicide topic. The Epidemiology and Prevention for Injury Control Branch (EPIC) staff matched and linked homicide records from the Department of Justice (DOJ) with death records from DHS for 1990 through 1997. The matching was performed using probabilistic matching software. Of the 30,065 DOJ recorded homicides during the eight-year period, we linked 26,637 (88.6%) to death records. This linkage process proved to be accurate and useful for studying homicide in greater detail. Specifically, we present data on the victim-offender relationship, the precipitating event, and the location of the homicide.

✍ 1990 United States Census data (Report CP-1-6) was used to classify urban versus rural county of residence in our special topic on Pedestrian vs. MV Injury. We classified county of residence into three categories, based on percent by population living in urban areas. The general criterion for an urban area is that it comprises one or more places and the adjacent densely settled surrounding territory that together have a minimum of 50,000 persons. The specific counties falling in the three categories follow:

Low Urban	**Medium Urban**	**High Urban**
(0-46%)	**(47-84%)**	**(85-100%)**
Alpine	Butte	Alameda
Amador	Fresno	Contra Costa
Calaveras	Humboldt	Los Angeles
Colusa	Imperial	Marin
Del Norte	Inyo	Orange
El Dorado	Kern	Riverside
Glenn	Kings	Sacramento
Lake	Madera	San Bernardino
Lassen	Merced	San Diego
Mariposa	Monterey	San Francisco
Mendocino	Napa	San Joaquin
Modoc	Placer	San Mateo
Mono	San Benito	Santa Barbara
Nevada	San Luis Obispo	Santa Clara
Plumas	Shasta	Santa Cruz
Sierra	Sonoma	Solano
Siskiyou	Sutter	Stanislaus
Tehama	Tulare	Ventura
Trinity	Yuba	Yolo
Tuolumne		

Appendix

Tables

Appendix Table A1. Fatal Injury Rates (per 100,000) by Cause of Injury and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Injuries	**3,915**	**68**	**1,163**	**50**	**1,045**	**53**	**1,045**	**93**	**662**	**187**
Suicide	1,148	20	397	17	335	17	308	27	108	31
Fall	823	14	76	3	153	8	260	23	334	94
MV Occupant	640	11	196	8	201	10	189	17	54	15
MV vs. Pedestrian	305	5	96	4	90	5	83	7	36	10
Homicide	219	4	111	5	52	3	38	3	18	*
Poisoning	177	3	107	5	35	2	24	2	11	*
Fire Flames Or Substance	110	2	30	1	41	2	28	2	11	*
Suffocation	97	2	20	1	20	1	25	2	32	9
Drowning & Submersion	94	2	27	1	24	1	28	2	15	*
Late Effects	53	1	16	*	20	1	11	*	6	*
Undetermined Intent	45	1	13	*	17	*	5	*	10	*
Other Transport	41	1	22	1	12	*	5	*	2	*
Environmental	38	1	7	*	13	*	9	*	9	*
Other Unintentional	31	1	3	*	10	*	7	*	11	*
MV vs. Pedal Cycle	23	0	10	*	3	*	10	*	0	*
Machinery In Operation	19	*	11	*	5	*	3	*	0	*
Struck By Object	15	*	6	*	2	*	4	*	3	*
Non MV Pedal Cycle	7	*	1	*	4	*	2	*	0	*
Electricity	6	*	4	*	2	*	0	*	0	*
Motorcyclist	6	*	2	*	3	*	0	*	1	*
Explosives	4	*	1	*	1	*	2	*	0	*
Foreign Body	4	*	1	*	0	*	2	*	1	*
Overexertion	4	*	1	*	1	*	2	*	0	*
Firearm, Unintentional	2	*	2	*	0	*	0	*	0	*
Off Road MV	2	*	2	*	0	*	0	*	0	*
Cutting Or Piercing	1	*	0	*	1	*	0	*	0	*
Legal Intervention	1	*	1	*	0	*	0	*	0	*

* Rates were not computed for fewer than 20 cases.

Note: Table exhibits original (pre-matrix) California injury categories

Source: California Department of Health Services, death records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Appendix Table A2. Nonfatal Hospitalized Injury Rates (per 100,000) by Cause of Injury and Age, California Residents Age 55 and Over, 1995

	All		55-64		65-74		75-84		85+	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Total Injuries	**85,610**	**1,490**	**14,043**	**607**	**20,891**	**1,069**	**28,942**	**2,579**	**21,734**	**6,143**
Fall	60,531	1,054	6,298	272	13,066	669	22,466	2,002	18,701	5,286
MV Occupant	4,609	80	1,450	63	1,521	78	1,240	111	398	112
Other Unintentional	3,343	58	603	26	964	49	1,056	94	720	204
Poisoning	2,902	51	786	34	965	49	802	71	349	99
Late Effects	2,073	36	699	30	654	33	486	43	234	66
Overexertion	1,956	34	588	25	604	31	520	46	244	69
Self-inflicted	1,517	26	657	28	421	22	316	28	123	35
Struck by Object	1,139	20	344	15	342	18	275	25	178	50
MV vs. Pedestrian	1,060	18	333	14	356	18	275	25	96	27
Environmental	1,042	18	273	12	318	16	300	27	151	43
Assault	983	17	458	20	275	14	171	15	79	22
Fire Flames or Substance	732	13	234	10	211	11	195	17	92	26
Cutting or Piercing	679	12	275	12	241	12	123	11	40	11
Other Transport	649	11	196	8	196	10	166	15	91	26
Foreign Body	563	10	123	5	181	9	179	16	80	23
Suffocation	539	9	84	4	180	9	183	16	92	26
Non MV Pedal Cycle	364	6	181	8	115	6	53	5	15	*
Machinery in Operation	245	4	137	6	69	4	33	3	6	*
Motorcyclist	230	4	125	5	70	4	23	2	12	*
Undetermined Intent	131	2	46	2	37	2	31	3	17	*
MV vs. Pedal Cycle	105	2	48	2	39	2	14	*	4	*
Off Road MV	72	1	31	1	25	1	13	*	3	*
Explosives	40	1	18	*	16	*	4	*	2	*
Firearm, Unintentional	37	1	20	1	11	*	6	*	0	*
Drowning & Submersion	30	1	13	*	6	*	5	*	6	*
Electricity	25	0	15	*	4	*	5	*	1	*
Legal Intervention	14	*	8	*	4	*	2	*	0	*

* Rates were not computed for fewer than 20 cases.

Note: Table exhibits original (pre-matrix) California injury categories

Source: California Office of Statewide Health Planning and Development, hospital discharge records, and California Department of Finance, 1970-1996 Race/Ethnic Population Estimates, January 1998.

Appendix Table A3. Hospital Charges and Length of Stay (in Days) by Cause of Injury, California Residents Age 55-64, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Injuries	**14,360**	**$20,621**	**$296,123,822**	**6.9**	**98,449**
Fall	6,283	$19,054	$119,716,543	7.5	47,250
MV Traffic	1,999	$30,175	$60,319,172	6.4	12,714
» Occupant	1,387	$28,323	$39,283,991	5.6	7,831
» Pedestrian	334	$37,281	$12,451,756	8.8	2,926
» Motorcyclist	123	$29,562	$3,636,112	5.6	691
» Pedal Cyclist	48	$55,355	$2,657,063	10.3	496
» Other MV	9	*	$115,447	*	34
» Unspecified	98	$22,192	$2,174,803	7.5	736
Poisoning, Unintentional	798	$12,904	$10,297,630	3.9	3,087
Late Effects	714	$20,486	$14,627,016	8.8	6,302
Self-inflicted	656	$15,191	$9,965,281	4.3	2,809
» Poisoning	570	$11,698	$6,667,736	3.4	1,965
» Cutting & Piercing	49	$24,582	$1,204,528	7.0	341
» Firearms	*	$20,801	$374,421	*	50
» Hanging	*	$17,743	$124,204	*	31
» Other Self-inflicted	37	$43,092	$1,594,392	11.4	422
Unspecified	626	$21,220	$13,283,939	10.1	6,334
Overexertion	588	$11,620	$6,832,791	3.1	1,848
Assault	474	$25,859	$12,257,220	6.1	2,903
» Fight	143	$16,157	$2,310,441	5.0	714
» Firearms	69	$27,674	$1,909,509	6.5	447
» Cutting & Piercing	69	$23,036	$1,589,471	4.8	330
» Poisoning	1	*	$18,692	*	3
» Hanging	1	*	$414,351	*	30
» Other Assault	191	$31,491	$6,014,756	7.2	1,379
Struck By Object	303	$18,317	$5,550,093	5.0	1,503
Natural/Environmental	279	$14,578	$4,067,238	4.3	1,205
» Bites & Stings	171	$10,879	$1,860,372	3.5	603
» Other Environmental	108	$20,434	$2,206,866	5.6	602
Cutting & Piercing, Uninten.	276	$14,900	$4,112,275	4.3	1,192
Fire/Burn	243	$41,848	$10,169,081	20.5	4,992
» Hot Object/Substance	147	$33,787	$4,966,713	9.6	1,404
» Fire/Flame	96	$54,191	$5,202,368	37.4	3,588
Other Specified, Classifiable	239	$22,347	$5,340,874	5.7	1,369
Transport, non-MV	222	$22,559	$5,008,051	5.2	1,165
Pedal Cyclist, non-MV	177	$17,638	$3,121,961	4.1	722
Machinery	137	$17,471	$2,393,494	3.9	529
Suffocation	101	$45,776	$4,623,397	9.9	1000
Other Specified	95	$21,103	$2,004,794	8.2	778
Undetermined	48	$18,202	$873,687	5.7	274
Pedestrian, non-MV	34	$22,064	$750,182	6.2	210
Firearm, Unintentional	20	$20,224	$404,478	6.4	127
Drowning & Submersion	14	*	$171,369	*	30
Legal Intervention/War	9	*	$233,256	*	106

* Means not shown for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A4. Hospital Charges and Length of Stay (in Days) by Cause of Injury, California Residents Age 65-74, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Injuries	**21,605**	**$20,284**	**$438,244,943**	**7.4**	**159,890**
Fall	13,151	$18,545	$243,887,088	7.2	95,091
MV Traffic	2,093	$32,122	$67,232,240	6.9	14,406
» Pedestrian	362	$33,857	$12,256,139	7.7	2,775
» Pedal Cyclist	41	$30,864	$1,265,418	7.4	304
» Occupant	1,501	$32,796	$49,226,068	6.0	9,062
» Motorcyclist	68	$22,628	$1,538,708	6.0	405
» Other MV	22	$16,615	$365,540	5.0	109
» Unspecified	99	$26,064	$2,580,367	17.7	1,751
Unspecified	1,073	$19,570	$20,998,872	9.2	9,909
Poisoning, Unintentional	997	$13,461	$13,420,833	4.4	4,387
Late Effects	689	$20,918	$14,412,278	12.2	8,396
Overexertion	607	$12,458	$7,562,269	3.9	2,379
Self-inflicted	471	$17,900	$8,430,739	5.3	$2,513
» Poisoning	363	$14,518	$5,269,939	4.7	1,712
» Cutting & Piercing	46	$18,070	$831,203	8.0	366
» Firearms	29	$33,119	$960,457	4.9	143
» Hanging	2	*	$30,401	*	4
» Other Self-inflicted	31	$43,185	$1,338,739	9.3	288
Natural/Environmental	330	$13,470	$4,445,016	4.4	1,449
» Bites & Stings	182	$10,716	$1,950,294	3.8	684
» Other Environmental	148	$16,856	$2,494,722	5.2	765
Other Specified Classifiable	318	$25,673	$8,164,097	7.2	2,281
Struck By Object	307	$19,906	$6,111,079	12.5	3,828
Assault	285	$24,930	$7,104,973	7.5	2,142
» Fight	99	$17,647	$1,747,012	9.4	930
» Firearms	32	$54,173	$1,733,523	8.7	277
» Cutting & Piercing	25	$21,197	$529,919	3.8	96
» Poisoning	1	*	$2,770	*	2
» Hanging	1	*	$1,426	*	1
» Other Assault	127	$24,439	$3,090,323	6.5	836
Cutting & Piercing, Uninten.	243	$16,454	$3,998,437	5.2	1,269
Fire/Burn	233	$46,888	$10,924,826	16.1	3,744
» Hot Object, Substance	123	$31,822	$3,914,118	8.4	1,034
» Fire/Flame	110	$63,734	$7,010,708	24.6	2,710
Suffocation	220	$44,785	$9,852,590	15.7	3,463
Transport, Other	181	$23,497	$4,252,939	10.5	1900
Other Specified	128	$20,413	$2,612,837	7.0	891
Pedal Cyclist, non-MV	110	$16,641	$1,830,537	3.9	427
Machinery	70	$16,562	$1,159,337	11.7	820
Undetermined	43	$13,605	$585,024	6.6	282
Pedestrian, non-MV	34	$25,969	$882,947	5.5	188
Firearm, Unintentional	11	*	$182,171	*	40
Drowning & Submersion	7	*	$117,688	*	26
Legal Intervention/War	4	*	$76,126	*	59

* Means not shown for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A5. Hospital Charges and Length of Stay (in Days) by Cause of Injury, California Residents Age 75-84, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Injuries	**29,994**	**$19,038**	**$571,018,766**	**7.3**	**219,628**
Fall	22,770	$18,155	$413,399,461	7.1	161,495
MV Traffic	1,664	$30,205	$50,261,882	6.6	10,972
» Occupant	1,250	$28,121	$35,150,720	6.1	7,643
» Pedestrian	288	$41,056	$11,824,229	8.3	2,386
» Motorcyclist	23	$18,616	$428,177	8.5	195
» Pedal Cyclist	17	*	$554,044	*	88
» Other MV	15	*	$461,226	*	103
» Unspecified	71	$25,965	$1,843,486	7.8	557
Unspecified	1,316	$18,899	$24,871,112	10.6	13,932
Poisoning, Unintentional	834	$13,998	$11,674,031	4.6	3,802
Overexertion	526	$14,612	$7,686,113	7.2	3,770
Late Effects	501	$20,284	$10,162,468	10.0	5,027
Self-inflicted	356	$17,888	$6,368,175	5.4	1,910
» Poisoning	260	$14,891	$3,871,648	4.7	1,222
» Cutting & Piercing	39	$16,651	$649,370	7.2	279
» Firearms	24	$41,026	$984,618	5.5	131
» Hanging	2	*	$59,275	*	43
» Other Self-inflicted	31	$25,912	$803,264	7.6	235
Natural/Environmental	315	$5,040	$1,587,564	1.9	601
» Bites & Stings	141	$11,259	$1,587,564	4.3	601
» Other Environmental	174	$17,790	$3,095,415	6.0	1,045
Other Specified, Classifiable	278	$21,054	$5,853,086	6.0	1,658
Struck By Object	253	$19,091	$4,830,088	17.8	4,510
Suffocation	230	$40,827	$9,390,229	9.9	2,288
Fire/Burn	211	$29,427	$6,209,040	8.5	1,786
» Hot Object/Substance	141	$21,653	$3,053,094	8.0	1,130
» Fire/Flame	70	$45,085	$3,155,946	9.4	656
Assault	178	$26,031	$4,633,431	7.3	1,294
» Fight	56	$29,268	$1,639,012	6.8	379
» Firearms	10	*	$369,056	*	39
» Cutting & Piercing	5	*	$85,773	*	21
» Poisoning	1	*	$4,313	*	1
» Hanging	1	*	$42,898	*	10
» Other Assault	105	$23,737	$2,492,379	8.0	844
Transport, non-MV	145	$21,230	$3,078,420	6.8	990
Cutting & Piercing, Uninten.	125	$14,252	$1,781,501	5.4	674
Other Specified	124	$20,676	$2,563,833	8.0	933
Pedal Cyclist, non-MV	50	$25,090	$1,254,487	6.9	343
Undetermined	36	$17,969	$646,878	60.1	2,162
Pedestrian, non-MV	33	$18,635	$614,953	4.4	145
Machinery	33	$16,517	$545,065	4.1	135
Drowning/Submersion	6	*	$368,840	*	40
Firearm, Unintentional	6	*	$82,426	*	34
Legal Intervention/War	4	*	$60,268	*	22

* Means not shown for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A6. Hospital Charges and Length of Stay (in Days) by Cause of Injury, California Residents Age 85 and Over, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Injuries	**22,737**	**$17,255**	**$392,329,124**	**7.6**	**173,374**
Fall	19,181	$17,088	$327,757,758	7.6	145,364
Unspecified	961	$16,764	$16,109,900	8.4	8,060
MV Traffic	578	$26,545	$15,342,842	6.1	3,538
» Occupant	432	$24,902	$10,757,503	5.7	2,448
» Pedestrian	104	$32,140	$3,342,591	7.4	773
» Motorcyclist	13	*	$817,019	*	147
» Pedal Cyclist	4	*	$71,219	*	14
» Other MV	3	*	$43,673	*	5
» Unspecified	22	$14,129	$310,837	6.9	151
Poisoning, Unintentional	366	$12,409	$4,541,518	4.7	1,715
Overexertion	250	$12,944	$3,235,967	7.1	1,771
Late Effects	244	$17,599	$4,294,159	9.5	2,326
Natural/Environmental	174	$11,640	$2,025,338	4.6	801
» Bites & Stings	34	$9,907	$336,846	5.9	202
» Other Environmental	140	$12,061	$1,688,492	4.3	599
Struck By Object	164	$15,417	$2,528,413	23.3	3,814
Self-inflicted	134	$14,096	$1,888,911	5.0	676
» Poisoning	96	$12,338	$1,184,493	4.3	412
» Cutting & Piercing	13	*	$201,297	*	110
» Firearms	7	*	$182,531	*	53
» Other Self-inflicted	18	*	$320,590	*	101
Other Specified, Classifiable	131	$17,630	$2,309,518	10.1	1,323
Suffocation	125	$30,528	$3,815,985	7.7	968
Fire/Burn	97	$32,114	$3,115,025	9.3	902
» Hot Object/Substance	65	$20,328	$1,321,317	8.4	548
» Fire/Flame	32	$56,053	$1,793,708	11.1	354
Other Specified	88	$19,254	$1,694,331	9.9	868
Assault	83	$16,974	$1,408,818	6.1	508
» Fight	17	*	$332,380	*	146
» Firearms	8	*	$123,732	*	16
» Cutting & Piercing	9	*	$175,611	*	22
» Hanging	1	*	$7,606	*	2
» Other Assault	48	$16,285	$769,489	6.8	322
Transport, non-MV	65	$12,994	$844,617	4.3	280
Cutting & Piercing, Uninten.	43	$12,526	$538,609	4.5	194
Undetermined	19	*	$295,841	*	111
Pedal Cyclist, non-MV	11	*	$203,251	*	67
Pedestrian, Other	9	*	$198,854	*	39
Drowning, Submersion	7	*	$68,268	*	16
Machinery	6	*	$102,207	*	29
Battering	1	*	$4,075	*	4
Legal Intervention/War	1	*	$8,994	*	4

* Means not shown for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A7. Hospital Charges and Length of Stay
for Nonfatal Hospitalized Injuries by Disposition at Discharge,
California Residents Age 55-64, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Dispositions	**14,359**	**$20,622**	**$296,106,696**	**6.9**	**98,442**
Routine	9,685	$15,538	$150,481,850	4.4	42,878
Another Hospital	1,931	$35,038	$67,658,311	11.5	22,287
Within Same Hospital	874	$27,515	$24,048,040	18.9	16,515
Home Health Service	1,218	$25,090	$30,559,974	7.6	9,267
Died	311	$53,960	$16,781,540	10.9	3,397
Other Dispositions	224	$17,587	$3,939,599	10.9	2,444
Residential Care Facility	116	$22,736	$2,637,382	14.3	1,654

Note: One case with disposition unknown not shown, so data are not equivalent to Appendix Table A3.

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A8. Hospital Charges and Length of Stay
for Nonfatal Hospitalized Injuries by Disposition at Discharge,
California Residents Age 65-74, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Dispositions	**21,605**	**$20,284**	**$438,244,943**	**7.4**	**159,890**
Routine	9,699	$14,032	$136,094,390	4.2	40,601
Another Hospital	5,007	$26,224	$131,303,152	8.7	43,752
Within Same Hospital	3,022	$23,920	$72,286,930	12.2	36,958
Home Health Service	2,792	$19,683	$54,953,560	6.9	19,356
Died	698	$53,003	$36,996,227	23.6	16,497
Other Dispositions	249	$18,949	$4,718,420	6.4	1,600
Residential Care Facility	138	$13,712	$1,892,264	8.2	1,126

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A9. Hospital Charges and Length of Stay
for Nonfatal Hospitalized Injuries by Disposition at Discharge,
California Residents Age 75-84, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Dispositions	**29,994**	**$19,038**	**$571,018,766**	**7.3**	**219,628**
Routine	8,324	$13,374	$111,329,200	4.9	40,401
Another Hospital	10,467	$21,393	$223,915,773	7.4	77,812
Within Same Hospital	6,045	$20,453	$123,636,403	9.5	57,687
Home Health Service	3,486	$16,375	$57,082,558	7	24,563
Died	1,045	$42,269	$44,171,458	11.7	12,276
Other Dispositions	310	$18,670	$5,787,740	13.6	4,221
Residential Care Facility	317	$16,075	$5,095,634	8.4	2,668

Source: California Office of Statewide Health Planning and Development, hospital discharge records.

Appendix Table A10. Hospital Charges and Length of Stay
for Nonfatal Hospitalized Injuries by Disposition at Discharge,
California Residents Age 85 and Over, 1995

	Discharges	Mean Charges	Sum Charges	Mean Days	Sum Days
All Dispositions	**22,737**	**$17,255**	**$392,329,124**	**7.6**	**173,374**
Routine	3,763	$12,386	$46,609,307	5.2	19,467
Another Hospital	9,847	$18,192	$179,136,540	7.2	71,384
Within Same Hospital	5,447	$18,024	$98,174,522	7.7	41,673
Home Health Service	2,128	$13,871	$29,516,723	6.9	14,698
Died	1,002	$31,053	$31,114,873	21.4	21,439
Other Dispositions	212	$16,327	$3,461,403	6.4	1,367
Residential Care Facility	338	$12,769	$4,315,756	9.9	3,346

Source: California Office of Statewide Health Planning and Development, hospital discharge records.